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December 1980

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Introduction

This report contains abstracts of new technical reports, journal articles, and other documents resulting from research supported by the Directorate for Engineering and Applied Science (EAS) of the National Science Foundation. These citations have been compiled to alert members of the scientific and technical community to current research results.

The programs of the Directorate seek to strengthen the U.S. engineering and applied science research base and enhance the links between research and applications in addressing selected national goals. This is accomplished by identifying and supporting basic research across a broad spectrum of engineering and applied research and related activities that have high potential for contributing to the understanding and resolution of significant societal problems.

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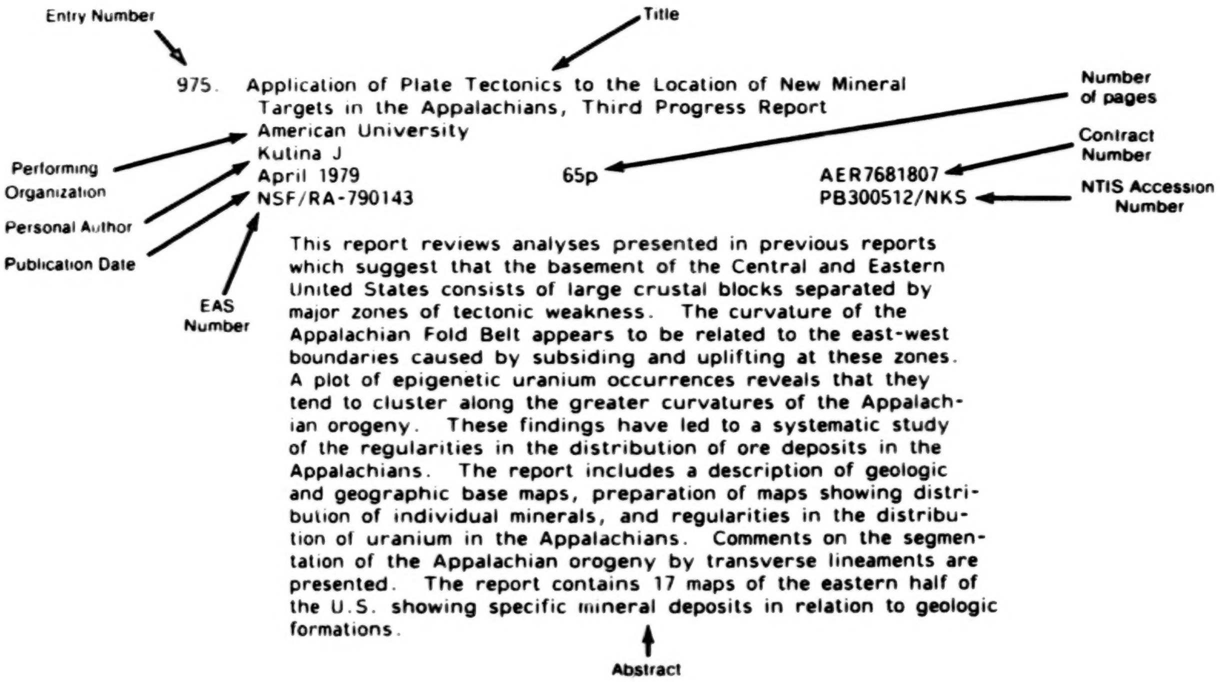

975. Application of Plate Tectonics to the Location of New Mineral Targets in the Appalachians, Third Progress Report
American University
Kutina J
April 1979 65p AER7681807
NSF/RA-790143 PB300512/NKS

This report reviews analyses presented in previous reports which suggest that the basement of the Central and Eastern United States consists of large crustal blocks separated by major zones of tectonic weakness. The curvature of the Appalachian Fold Belt appears to be related to the east-west boundaries caused by subsiding and uplifting at these zones. A plot of epigenetic uranium occurrences reveals that they tend to cluster along the greater curvatures of the Appalachian orogeny. These findings have led to a systematic study of the regularities in the distribution of ore deposits in the Appalachians. The report includes a description of geologic and geographic base maps, preparation of maps showing distribution of individual minerals, and regularities in the distribution of uranium in the Appalachians. Comments on the segmentation of the Appalachian orogeny by transverse lineaments are presented. The report contains 17 maps of the eastern half of the U.S. showing specific mineral deposits in relation to geologic formations.

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DIVISION OF ELECTRICAL, COMPUTER, AND SYSTEMS ENGINEERING (ECSE)

Electrical Optical Communications

1175. Image Coding: Report of a Workshop Held at Boulder, Colorado, on December 14-16, 1977
University of California at Davis, Department of Electrical and Computer Engineering
Algazi VR
September 1979 189p ENG7709121, ENG7811521
NSF/RA-790300 PB80-164817/NKS

Twenty-one participants representing a broad range of interest convened to exchange information, opinions, and predicitions in the field of image coding. Objectives focused on the following area: (1) a broad and critical assessment of the state of knowledge in image coding and the trends in image transmission and decoding; (2) a description of the areas of research and experimentation needed for a systematic understanding and implementation of image coding; and (3) a determination of the needed future research both to provide fundamental knowledge and for the use of recent technological advances in image coding. Presentations and discussions are summarized with major emphases on the human observer, image as data sources, the theoretical basis of image coding, a survey of image encoders, and a survey of applications and implementations.

1176. Design and Analysis of an NMOS Operational Amplifier with Depletion Loads
University of Illinois at Urbana-Champaign, Coordinated Science Laboratory
Davis RD
August 1979 55p ENG7811758
NSF/RA-790552 ADA085313/5/NKS

The MOS transistor has become the building block for LSI digital circuits in recent years. Its small device size and high fabrication yield have made it particularly attractive. Recently, however, the application of MOS technology to analog circuits has been studied. One particularly useful analog circuit is the operational amplifier. The ability to fabricate an all MOS operational amplifier on an LSI chip can increase the flexibility of many signal processing tasks, such as filtering, D/A and A/D conversion. In addition, the amplifier would be compatible with other MOS circuit elements. In this thesis a single channel NMOS operational amplifier with depletion loads is designed. Computer simulation using the SPICE circuit analysis program is used as a design aid and to evaluate the final design, as this lends itself easily to the study of parameter variations within the circuit. Of particular interest is the method of internal frequency compensation of the amplifier leading to design criteria for several small signal parameters. These small signal parameters are directly related to device geometry and D.C. bias conditions. Other characteristics and performance criteria of the amplifier are also discussed. (Author Abstract)

1177. Event Location Using Recursive Least Squares Signal Processing
Massachusetts Institute of Technology, Research Laboratory of Electronics
Dove WP, Oppenheim AV
April 1980 6p ENG7624117
NSF/RA-800253 ADA085614/6/NKS

The problem of locating the position of individual pulses within a group of overlapping pulses can be simplified by preprocessing the data to reduce the overlap. This paper proposes the use of Recursive Least Squares (RLS) prediction for this purpose. The pulse compression performance of two signals derived from the RLS algorithm is compared using all-pole data with different noise levels, and the effects of zeroes in the data and prefiltering are discussed.

System Theory and Operations Research

1178. Two-Dimensional Discrete Hilbert Transform and Computational Complexity Aspects in Its Implementation
University of Pittsburgh, Department of Electrical Engineering
Bose NK, Prabhu KA
August 1979 5p ENG7684161
NSF/RA-790511

It is first shown that the impluse response operator for a two-dimensional discrete Hilbert transform (DHT), although not by itself sum-separable, becomes so after appropriate classification. Subsequently, it is proved that the multiplicative complexity of computation of a two-dimensional DHT is not greater than twice the sum of multiplicative complexities of two one-dimensional DHT's. Finally, the consequences of Winograd's algebraical computational complexity theory on the problem considered here are discussed.

Note: Available from IEEE Transactions on Acoustics, Speech, and Signal Processing, Volume ASSP-27, Number 4, August 1979, pp 356-360.

1179. New Inversion Formulas for Matrices Classified in Terms of Their Distance from Toeplitz Matrices
Stanford University, Information Systems Laboratory
Friedlander B, Morf M, Kailath T, et al
1979 30p ENG7518952
NSF/RA-790513

The problem of solving linear equations, or equivalently of inverting matrices, arises in many fields. Efficient recursive algorithms for finding the inverses of Toeplitz or displacement-type matrices have been known for some time. By introducing a way of characterizing matrices in terms of their "distance" from being Toeplitz, a natural extension of these algorithms is obtained. Several new inversion formulas for the representation of the inverse of non-Toeplitz matrices are also presented.

Note: Available from Linear Algebra and Its Applications, Volume 27, 1979, pp 31-60.

1180. A Robust Discrete State Approximation to the Optimal Nonlinear Filter for a Diffusion
Brown University, Division of Applied Mathematics and Engineering
Kushner HJ
April 1979 9p ENG7303846
NSF/RA-790514

A robust computable approximation to the nonlinear filtering problem for a diffusion model is treated, where the system and data models are given, by $dx=f(x)dt+\sigma(x)dz$, $dy=g(x)dt+dw$. The approximation (with approximation parameter $\underline{h}$) is robust in the sense that it is locally Lipschitz continuous in the data $\underline{y}(\cdot)$ (sup norm) uniformly in $\underline{h}$, and, as $\underline{h} \to 0$, it converges to the optimal filter for the diffusion.

Note: Available from Stochastics, Volume 3, 1979, pp 75-83.

1181. Evaluation of Projection Algorithms, Technical Report
Michigan State University, Department of Computer Science
Biswas G, Jain AK, Dubes R
September 1979 55p ENG7611936
NSF/RA-790536 PB80-163702/NKS

This paper reviews several linear and nonlinear mapping algorithms for the projection of patterns from a high-dimensional space to two dimensions. These two-dimensional representations allow a quick visual observation of the data set under consideration. A combination of two popular mapping algorithms - Sammon's mean square error technique and the Triangulation method - is proposed to overcome the limitations in the individual algorithms. Some factors which described the goodness of a projection are described, and a comparison is made of six of these algorithms by running them on four data sets. The results obtained are tabulated and their significance is discussed.

1182. Queueing Networks, Technical Report
Virginia Polytechnic Institute and State University, Department of Industrial Engineering and Operations Research
Disney RL
December 1979 35p ENG7722757
NSF/RA-790537 ADA081257/8/NKS

The study of queueing networks is a rather recent addition to queueing theory. This paper reviews about the last 20 years of developments in the area. Primary emphasis is placed on Jackson networks and the major contribution of Kelly. It discusses queue length processes, waiting time processes, busy period processes, and departure processes. Also noted are a few new studies that have appeared in the area of network flows. Topics that are not discussed in detail in the paper are briefly noted in the final section. The bibliography can serve as an introduction for further reading in the area. (Author Abstract)

1183. Life and Death Decision Analysis, Research Report No. EES-DA-79-2
Stanford University, Department of Engineering-Economic Systems
Howard RA
December 1979 154p ENG7681056
NSF/RA-790539 ADA081424/4/NKS

No assertion can command attention in time of emergency like, "It's a matter of life and death." The problem of making decisions that can affect the likelihood of death is one of the most perplexing facing the analyst. Individuals are often called upon to make decisions that affect their safety. Increasingly, that decision is made by others. Yet most approaches to life and death decision-making concentrate on the value of an individual's life to others rather than to himself. These approaches are both technically and ethically questionable. This report develops a model for an individual who wishes to make life and death decisions on his own behalf or who wishes to delegate them to his agents. An individual can use this model if he is willing to trade between the quality and the quantity of his life. A simplified version requires him to establish preference between the resources he disposes during his lifetime and the length of it, to establish probability assessments on these quantities, to characterize his ability to turn present cash into future income, and to specify his risk attitude. One can use this model to determine both what an individual would have to be paid to assume a given risk and what he would pay to avoid a given risk. The risks may range from those that are virtually infinitesimal to those that are imminently life threatening. This model resolves a paradox posed by previously proposed models. In this model there is no inconsistency between an individual's refusing any amount of money, however large, to incur a large enough risk, and yet being willing to pay only a finite amount, his current wealth, to avoid certain death.

1184. The Stability and Stabilizability of Infinite Dimensional Linear Systems via Liapunov's Direct Method
University of California at Los Angeles, Department of System Science
Ross AP
September 1979 114p ENG7511876
NSF/RA-790553 ADA085299/6/NKS

This dissertation attempts to extend to infinite dimensional linear systems in a Hilbert space some of the stability and stabilizability results that have been obtained for finite dimensional systems using the direct method of Liapunov. The familiar finite dimensional applications of Liapunov's direct method to the stability and stabilizability of linear systems involve the existence of certain positive matrices which satisfy some form of algebraic Riccati equation. Former extensions of these results to infinite dimensional systems in Hilbert space apply exclusively to exponential (uniform asymptotic) stability. Recently, recognizing that exponential stability is a very strong property to expect of some physical systems, some attention has been paid to weaker forms of stability. This thesis generalizes the results of Liapunov's direct method to infinite dimensional systems in a manner that addresses these weaker forms of stability. This is accomplished by developing the distinct concepts of nonnegative, positive, and strictly positive operators. The resulting stability and stabilizability theorems are stated in terms of weak stability, but they are shown to be applicable, in many cases, to strong and exponential stability as well.

1185. Foundations of Feedback Theory for Nonlinear Dynamical Systems
University of California, Department of Electrical Engineering and Computer Sciences and Electronics Research Laboratory
Desoer CA, Wang Y-T
February 1980 10p ENG7684522
NSF/RA-800142

The fundamental properties of feedback for nonlinear, time-varying, multi-input, multi-output, distributed systems is studied. The classical Black formula is generalized to the nonlinear case. Achievable advantages and limitations of feedback in nonlinear dynamical systems are classified and studied in five categories: desensitization, disturbance attenuation, linearizing effect, asymptotic tracking and disturbance rejection, and stabilization. Conditions under which feedback is beneficial for nonlinear dynamical systems are derived. Results show that if the appropriate linearized inverse return difference operator is small, then the nonlinear feedback system has advantages over the open-loop system. Several examples are provided to illustrate the results.

Note: Available from IEEE Transactions on Circuits and Systems, Volume CAS-27, Number 2, February 1980, pp 104-123.

1186. Polyextremal Principles and Separably-Infinite Programs, Research Report
University of Texas at Austin, Center for Cybernetic Studies
Charnes A, Gribik P, Kortanke K, et al
January 1980 45p ENG7825488
NSF/RA-800240 ADA081943/3/NKS

As a direct extension of Charnes's characterization of two-person zero-sum constrained games by linear programming, it is shown how a general class of saddle value problems can be reduced to a pair of uniextremal dual separably-infinite programs. These programs have an infinite number of variables and an infinite number of constraints, but only a finite number of variables appear in a infinite number of constraints and only a finite number of constraints have an infinite number of variables. The conditions under which the characterization holds are among the more general ones appearing in the literature sufficient to guarantee the existence of a saddle point of concave-convex function. The key construction involves augmenting a given player's original set of variables by generalized finite sequences determined by the other player's constraint set and objective function. A duality theory is developed which includes complementarity conditions, thereby making contact with the numerical treatment of semi-infinite programming.

1187. New Algorithms for Nonlinear Least Squares and Bayesian Parameters Estimation, Technical Summary Report
University of Wisconsin, Mathematics Research Center
Stewart WE, Sorenson JP
February 1980 27p ENG7624368
NSF/RA-800288 ADA083819/3/NKS

Some new algorithms are presented for fitting mathematical models to multiple-response experiments. These algorithms give estimates of the parameters in a user-defined predictor model, and also estimate the parameters of a Gaussian model of the observational error distribution. The development is based on Bayes's theorem, and provides a natural extension of known least-squares estimation methods. Allowance is made for missing values of responses, which occur frequently in practical work.

1188. Nd:Phosphate Glass Mode-Locked Oscillator and Amplifier System
City University of New York, City College, Department of Physics
Lu PY, Ho PP, Alfano RR
1979 2p ENG7680212
NSF/RA-790451

The use of a single intense picosecond laser pulse is important for understanding basic processes in materials by time-resolved laser spectroscopy. The generation of such pulses is usually accomplished by using a glass mode-locked oscillator, a single pulse selector, and an amplifier. Two types of laser glass are commonly available: Nd-doped silicate and phosphate rods. The phosphate glass has a larger gain coefficient and lower nonlinear index n_2 than the silicate glass by at least a factor of 1.4 and 1.1, respectively. A 100-mJ 6-ps pulse was produced from a mode-locked oscillator and an 8 in long amplifier system using Kigre Q-88 Nd:phosphate rods. Results show that the output face of the phosphate amplifier rod is susceptible to damage at that high pulse energy.

Note: Available from IEEE Journal of Quantum Electronics, Volume QE-15, Number 6, June 1979, pp 406-407.

DIVISION OF CHEMICAL AND PROCESS ENGINEERING (CPE)

Chemical and Biochemical Processes

1189. Ultraviolet-Sensitive Photographic Process Using Enzymes
Auburn University, Department of Chemistry
Kuan KN, Lee YY, Melius P
1980 10p ENG7615745
NSF/RA-800072

A unique silver-free and ultraviolet (UV)-sensitive photographic process using enzymes has been developed. It utilizes -chymotrypsin acylated to a light-sensitive stereoisomeric ester as the basic photographic material. When UV light is exposed to the film, the signal is registered by the appearance of melanin pigment through the chymotrypsin-mediated activaton of pre-tyrosinase.

Note: Available from Biotechnology and Bioengineering, Volume XXII, pp 1725-1734.

Engineering Energetics

1190. Optical Kerr Effect in Liquids
City University of New York, City College, Department of Physics
Ho PP, Alfano, RR
1979 18p ENG7680212
NSF/RA-790452

An experimental study was undertaken to measure the optical Kerr effect (OKE) in liquids induced by picosecond laser pulses. The effects of different parameters on the dynamics of the OKE are described. The following parameters were investigated: the spatial and temporal profiles of the laser pulses, the intensity of the exciting laser pulse, the length of the Kerr gate, the concentration of the sample solution, the relaxation time of the sample, the temperature, and the pair correlation factor. The nonlinear indices of refraction of 29 neat liquids were measured and tabulated.

Note: Available from Physical Review A, Volume 20, Number 5, November 1979, 2170-2187.

Particulate and Multiphase Processes

1191. Research Needs and Opportunities in Mixing, Including Particulates, National Science Foundation Workshop, Held at Rindge, New Hampshire, on August 21-26, 1977
Case Western Reserve University, Department of Biomedical Engineering
Adler RJ
July 1979 71p ENG7720150
NSF/RA-790401 PB80-176449/NKS

This sixth biennial mixing conference considered fruitful research directions as perceived by a cross-section of professionals in the field. A corollary result was the exchange and dissemination of theoretical, experimental, and practical information on mixing. The presentations encompassed a wide variety of areas within the general field of mixing. The 22 papers cover all phases of mixing including homogeneous solutions, liquid-liquid dispersions, solid-liquid slurries, gas-liquid contactors, and solid-gas-liquid systems. Viscosities of fluids reported a range from low to extremely high and include non-newtonian fluids. Basic and applied aspects of blending, suspensions, mass transfer, dispersion, chemical or biological reactions, heat transfer, and scale-up are discussed. Presentations highlight the complicated nature of mixing systems and the desire of workers in the field to understand these systems. Many creative, specific suggestions and formative ideas emerge from these papers. The report presents a comprehensive summary of the papers together with transcriptions of the presentations.

Kinetics, Catalysis and Reaction Engineering

1192. The Dynamic Behavior of a CSTR: Some Comparisons of Theory and Experiment
University of Illinois, Department of Chemical Engineering
Schmitz RA, Bautz RR, Ray WH, et al
1979 8p ENG7421094
NSF/RA-790444

Mathematical methods employed recently in a theoretical study by Uppal et al. (1974) are applied to the second-order homogeneous reaction between sodium thiosulfate and hydrogen peroxide and are combined with experimental investigations of that reaction using a nonadiabatic continuous stirred tank reactor (CSTR). A complete portrayal of the expected behavior of that reaction system is presented in parameter space. Some new experimental studies of reactor instabilities are presented and linked to that portrayal. Close agreement is shown between theoretical predictions and experimental data.

Note: Available from AIChE Journal, Volume 25, Number 2, March 1979, pp 289-297.

DIVISION OF CIVIL AND MECHANICAL ENGINEERING (CME)

Water Resources and Environmental Engineering

1193. Phosphorus Solubilization During Anaerobic Decomposition of Algae (Final Report, October 15, 1977 - October 15, 1978)
State University of New York at Buffalo, Department of Civil Engineering
Middleton AD, Narbaitz RM, Uchida A
January 1980 45p ENG7715365
NSF/RA-800241 PB80-157225/NKS

The objective of this work was to investigate the significance of sulfate reduction in solubilizing phosphate in aqueous systems. The principal accomplishments were related to experimental design and theoretical considerations. The following tasks were performed: (1) a dynamic model for algal growth was developed; (2) a literature search on algal culturing was conducted; and (3) a chemical equilibrium model was applied to an iron-phosphate-sulfide-carbonate aqueous system.

Structural Mechanics

1194. Studies on High-Frequency Vibrations of Buildings, I: The Column Effects (EERC-79/21)
University of California at Berkeley, Earthquake Engineering Research Center
Lubliner J
August 1979 32p ENG7701597
NSF/RA-790351 PB80-158553/NKS

It is shown that, when column mass is taken into account in the vibration of buildings, the system acquires additional degrees of freedom. If column mass is small compared to floor mass, then the modes obtained from conventional analysis persist virtually unchanged; the additional modes involve almost exclusively column motion, the characteristic frequencies being in the low audio range. The nature of the modes, as well as the transmission of ground motion, depends on whether the columns in adjacent stories are tuned to each other.

1195. On Response of Structures to Stationary Excitation (EERC-79/32)
University of California at Richmond, Earthquake Engineering Research Center
Der Kiureghian A
December 1979 43p ENG7905906
NSF/RA-790398 PB80-166929/NKS

Stationary responses of single- and multi-degree-of-freedom structures subjected to stationary input excitations are studied. Using a modal superposition procedure, closed form solutions for the first three spectral moments of response to white-noise and filtered white-noise inputs are derived. These solutions account for the correlation between modal responses of multi-degree structures; thus, they are applicable to structures with closely spaced modes. Special attention is given to excitations which are typical of earthquake ground motions. Various quantitites of response can be obtained in terms of the three spectral moments. These include the mean squares of the response and its time derivative and, in the special case of Gaussian response, the mean zero-crossing rate and the mean, the variance, and the distribution of the peak response over a specified duration. In this regard, improved semi-empirical relations for the mean and variance of the peak of a stationary Gaussian process are developed. Results from the study demonstrate the range of applicability of the white-noise model as an approximation for wideband inputs.

Solid Mechanics

1196. Stress Intensity Factors in Two Bonded Elastic Layers Containing Cracks Perpendicular to and on the Interface, Part I: Analysis
Lehigh University
Lu MC, Erdogan F
January 1980 31p ENG7809737
NSF/RA-800242 N8018428/6/NKS

The basic crack problem which is essential for the study of subcritical crack propagation and fracture of layered structural materials is considered. Because of the apparent analytical difficulties, the problem is idealized as one of plane strain or plane stress. An additional simplifying assumption is made by restricting the formulation of the problem to crack geometries and loading conditions which have a plane of symmetry perpendicular to the interface. The general problem is formulated in terms of a coupled system of four integral equations. For each relevant crack configuration of practical interest, the singular behavior of the solution near and at the ends and points of intersection of the cracks is investigated and the related characteristic equations are obtained. The edge crack terminating at and crossing the interface, the T-shaped crack consisting of a broken layer and a delamination crack, the cross-shaped crack which consists of a delamination crack intersecting a crack which is perpendicular to the interface, and a delamination crack initiating from a stress-free boundary of the bonded layers are some of the practical crack geometries considered.

1197. Stress Intensity Factors in Two Bonded Elastic Layers Containing Cracks Perpendicular to and on the Interface, Part 2: Solution and Results
Lehigh University
Lu MC, Erdogan F
January 1980 53p ENG7809737
NSF/RA-800243 N8018429/4/NKS

The numerical method is given for solving the plane problem for two bonded infinite dissimilar elastic strips which contain cracks of various configurations. The problem is intended to approximate a composite beam or a plate having cracks perpendicular to and on the interface of the two layers.

1198. Lighter and Stronger
Oakland University, School of Engineering
Durelli AJ, Rajaiah K
February 1980 54p ENG7707974
NSF/RA-800244 ADA081317/0/NKS

A new method has been developed that permits the direct design of shapes of two-dimensional structures and structural components, loaded in their plane, within specified design constraints and exhibiting optimum distribution of stresses. The method uses photoelasticity and requires a large field diffused light polariscope. Several problems of optimization related to the presence of holes in finite and infinite plates, subjected to uniaxial and biaxial loadings, are solved parametrically. Some unexpected results have been found: (1) the optimum shape of a large hole in a bar of finite width, subjected to uniaxial load, is "quasi" square, but the transverse boundary has the configuration of a "hat"; (2) for the small hole in the large plate, a "barrel" shape has a lower s.c.f. than the circular hole and appreciably higher coefficient of efficiency; and (3) the optimum shape of a tube, subjected to diametral compression, has small "hinges" and is much lighter and stronger than the circular tube.

1199. Viscoelastic Analysis of Adhesively Bonded Joints
Lehigh University
Delale F, Erdogan F
March 1980 28p ENG7809737
NSF/RA-800252 N8026700/8/NKS

An adhesively bonded lap joint is analyzed by assuming that the adherends are elastic and the adhesive is linearly viscoelastic.

After formulating the general problem, a specific example for two identical adherends bonded through a three-parameter viscoelastic solid adhesive is considered. The standard Laplace transform technique is used to solve the problem. The stress distribution in the adhesive layer is calculated for three different external loads, namely, membrane loading, bending, and transverse shear loading. The results indicate that the peak value of the normal stress in the adhesive is not only consistently higher than the corresponding shear stress but also decays slower.

DIVISION OF APPLIED RESEARCH (DAR)

Applied Social and Behavioral Sciences

Telecommunications Policy and Regulation Research

1200. Local Consumer Information Services, Final Report
Stanford University, Engineering-Economic Systems Department
April 1979 58p APR7523685
NSF/RA-790137 PB301314/NKS

The concept of improving market operation by providing better information is extended to coverage of local services. Effective execution and its consequences are discussed. This study has concluded that it can be done successfully but it has not yet been done in a systematic, comprehensive way. The report describes the role of information in the following types of local service markets: automobile repair; health; jobs; real estate; financial; legal; and local government. The application of economic theory as a guide to planning a local consumer information service is discussed. Also presented are a business plan for a consumer information service and the steps required to start such a service. Other areas considered are legal issues, usually involving defamation and trade disparagement of local service providers, and policy implications.

Public Management and Service Delivery

1201. Using New Governance Tools to Solve Local Government Problems, A Program of Research into Emerging Nonservice Approaches to Social Welfare and Community Development Problems, Summary Materials
SRI International, Center for Urban and Regional Policy
Waldhorn SA, Gollub JO, Benveniste DR, et al
January 1979 49p DAR7722258
NSF/RA-790025 PB80-108111/NKS

This project focuses on the identification and assessment of emerging forms of governance categorized as "nonservice approaches" to urban and rural problems. Such approaches are alike in that they involve neither the direct delivery of service nor major public investment. The six nonservice policy approaches--regulation and deregulation, tax policy change, private sector involvement, institutional reform, self-help, and legal advocacy--provide a continuum of tools that can both expand the policy space of local government and increase the overall resources that can be applied to achieving social welfare and community development objectives. Three exploratory studies are examined: nonservice approaches to neighborhood problems; nonservice approaches to social welfare problems; and citizen participation in nonservice planning.

1202. Federal and State Mandating on Local Governments, an Exploration of Issues and Impacts, Final Report
University of California, Graduate School of Administration
Lovell CH, Kneisel R, Neiman M, et al
June 1979 299p DAR7720482
NSF/RA-790138 PB301408/NKS

Research findings and preliminary analyses of some key theoretical and practical issues of mandating are presented. The nature of multiple mandate issues, from political-institutional issues to operational issues, is summarized. Definitional problems are discussed, and a framework for coping with the numerous meanings of the mandate concept is presented. The Federal mandate inventory and the inventories of mandates in the states of California, Washington, New Jersey, Wisconsin, and North Carolina are analyzed. The methods by which the inventories were developed are described. Mandates are enumerated by functional areas, types, origins, implementing agencies, age, and other characteristics. A simple economic model was constructed which may be used to examine the effects of different types of mandates on budget allocations and to generate hypotheses for further testing. The theoretical principles and general considerations around which the fiscal impact data gathering and analysis were organized are discussed in laymen's terms. The fiscal impact findings from the study of nearly 1,200 mandates in the ten pilot jurisdictions are presented and analyzed. The incidence of various cost categories among mandate types is analyzed. A method for studying the fiscal impact of mandates by concentrating measurement on new mandates is recommended.

1203. General Revenue Sharing Formula, Distributional and Equalization Effects of the General Revenue Sharing Formula and General Revenue Sharing Formula Alternatives, Working Paper No. 2
Center for Governmental Research, Inc.
Smith JO, Grasberger FJ
June 1979 206p APR7715726
NSF/RA-790139 PB80-106446/NKS

This paper presents an analysis of the distributional and equalization effects of the present and alternative formulas for the determination of entitlements for the General Revenue Sharing (GRS) program. It contains a synoptic review of background information on the existing GRS formulas, a brief discussion of major formula issues, a description of the frameworks used in analyzing present and alternative formulas, and several series of tables and maps depicting the effects of various formula modifications. The major objective of the analysis is the development of formula modifications that significantly increase the effectiveness of the Federal aid formula in equalizing among the states the relationship between GRS funding and a state's fiscal capacity and need. The principal criterion developed to measure the achievement of such equalization is the state-local revenue gap, the difference in yield arising from the application of a specified level of state-local effort to each state's capacity/need ratio. The analyses show that significant improvements in the equalization power of the GRS program can be attained by incorporating a need index into the present formula and by substituting a capacity-equalizing formula for the dual formula system.

1204. Developing and Applying Analytical Tools to Evaluate the Distributional and Equalization Effects of Federal Grant-in-Aid Formulas and to Improve Formula Performance (Formula Evaluation Project), Final Report
Center for Governmental Research
Grasberger FJ, Smith JO, Taddiken AJ
January 1980 204p APR7715726
NSF/RA-800009 PB80-180813/NKS

This report describes a project designed to develop information and analytical techniques to improve evaluative data on the performance of existing and alternative formula-distributed Federal grants-in-aid to state and local governments. The study includes a description, classification, and review of grant-in-aid formulas; formula issues and alternatives; a formula evaluation framework with respect to distributional impact; equalization analysis and the GAP analytical model; and formula evaluation results. Various aid programs are studied and working papers prepared for each. There are several major findings: (1) present formulas fail to equalize; (2) many modifications of existing formulas, particularly the elimination of dual formula systems, updating of data elements, elimination of constraints, adjustments for cost-of-government differentials, and use of income per need unit ratios, are called for on conceptual grounds; (3) virtually all such modifications improve formula performance; and (4) the analytical frameworks have proven to be flexible and adaptable tools for formula performance analysis.

1205. Essays in Public Finance and Financial Management, State and Local Perspectives
Municipal Finance Officers Association
Petersen JE, Spain CL, eds.
1979 90p APR7720340
NSF/RA-800016 PB80-184617/NKS

A definitive state-of-the-art report on current fiscal research in state and local government finance is presented in a collection of essays. Many disciplines and problems are covered: research and policy developments; major types of state and local taxes; state and local government expenditures; capital budgeting; state and local government cash management practices; state and local government debt policy and management; public employment, collective bargaining, and employee wages and pensions; accounting, auditing, and financial reporting; intergovernmental finance; public budgeting; state and local intergovernmental finance; revenue and expenditure forecasting by state and local governments; the state and local sector and the economy; overall performance and regional disparities; public policy issues in the schools; urban fiscal studies; and productivity improvement in the public sector.

Resource Economics

1206. Possibilities for Natural Resource Substitution in the U.S. Economy, Final Report
University of Washington, Department of Economics
Brown GM Jr, Field BC
September 1979 275p AER7706507
NSF/RA-790250 PB80-125578/NKS

The design and results of economic studies of factors affecting substitution of alternative products for natural resources undergoing serious depletion are reported. The theory and design of suitable models characterizing the substitution process are described. Models were used to study metal and forest product substitution. The project included measurement of substitution elasticities and estimation of the elasticity of substitution for selected resources for different countries, estimation of elasticity of substitution by stage, price elasticities of demand, elasticities of substitution and input price changes, input substitution models, and partial and full elasticities of substitution. Conclusions about price and demand elasticities are presented.

Micro-Economic Policy and Regulation

1207. Market Structure and Technological Performance in the Food Manufacturing Industry
University of Wisconsin at Madison, Department of Agricultural Economics
Mueller WF, Culbertson J, Peckham B, et al
September 1979 251p APR7603789
NSF/RA-790243 PB80-118920/NKS

A study of the sources of increased productivity in various food manufacturing industries is reported. The survey comprises the following: (1) examination of the relationship between the competitive structures of food industries and their research and development investments and outputs; (2) subsumption of the inventive activity of food manufacturing firms in broad perspective by examining sources of innovation originating both inside and outside food manufacturing industries (It examines qualitative and quantiative indices of innovation.); (3) a case study of the evolution of high fructose corn syrup, one of the most significant advances in food technology in recent decades; and (4) summary of major findings and their import for public policy. It is hoped that the inquiry provides knowledge useful in public policy decision-making influencing the organization of business. The appendix contains a classification of patents.

Applied Physical, Mathematical, and Biological Sciences and Engineering

Production Research

1208. Scheduling of Flexible Flowshops (Systems Aspects of Flexible Manufacturing Systems)
Massachusetts Institute of Technology, Laboratory for Information and Decisions Systems
Hitz KL
March 1979 78p DAR7817826
NSF/RA-790103 PB301218/NKS

The scheduling of production in a deterministic flexible flowshop is discussed. This is a serial arrangement of buffered multipurpose machines connected by a conveyor system which allows fully mechanized parts handling. Machines can be bypassed, and simultaneous processing of parts with different machine routes is possible. The problem considered is that of producing a range of part types in specified ratios, with known fixed transport and processing times. Optimal schedules are characterized as periodic loading sequences which minimize idle time on bottleneck machines once they have begun operating, while satisfying constraints on buffer capacity. The computation of optimal schedules by an implicit enumeration algorithm is discussed. Early computational results indicate that this formulation of the scheduling problem leads to significant savings when compared to the minimization of makespan or mean weighted finish time customary in the scheduling literature.

1209. Assembly of Interference Fits by Impact and Constant Force Methods, Master's Thesis
Massachusetts Institute of Technology, Charles Stark Draper Laboratory, Inc.
Selvage CC
June 1979 52p APR7418173
NSF/RA-790135 PB301289/NKS

The assembly of interference fits by two basic methods is investigated. The parts may be pressed together quasistatically, under a constant load, or be driven into place with a series of impacts. When the parts are pressed together, the important consideration is the static insertion force. Handbook formulas give an approximate value for the insertion force because the coefficient of friction is not known with certainty, and the assumed constant contact pressure is altered by the axial force through the Poisson effect. This thesis accounts for the Poisson effect, and shows that it becomes an important consideration when the product of Poisson's ratio, coefficient of friction, and the contact length to interference diameter ratio exceeds 0.1. The residual axial stresses resulting from assembly forces are analyzed in detail, and the minimum energy that must be supplied to begin insertion is calculated. An approximate energy analysis of the insertion of an interference fit by an impact load is presented. It takes into account the presence of an axial preload force which might be applied as the impact takes place. Two experiments show a good correlation between the theory and data for impact by hammer blows.

1210. General Methods to Enable Robots with Vision to Acquire, Orient and Transport Workpieces, Fifth Report
University of Rhode Island, Department of Electrical Engineering
Birk J, Kelley R, Brownell T, et al
August 1979 245p APR7413935, DAR7413935
NSF/RA-790230 PB80-106388/NKS

This is the fifth report of a four-year study to develop general methods by which robots with vision can acquire, orient, and transport workpieces for the purpose of increasing the range of industrial uses to which robots can be applied. A section on research context and philosophy addresses the relationship between the problem of giving robots the ability to work with unoriented objects and applications, not only in automating isolated machines but also in automated batch manufacturing systems, particularly those in which unoriented parts in containers are transported between machines and storage. Most of the concepts described in the fourth report are included in the 15 appendices that make up the major portion of this report. Two examples of robot systems are an automatic method of visually estimating the pose of an object held in a robot hand and a system employing vision that feeds workpieces directly from supply bins into machines and can be reprogrammed to service different workpieces.

1211. Advanced Industrial Robot Control Systems (Second Report, January 1, 1978 - July 1, 1978)
Purdue University, School of Electrical Engineering
Paul R, Luh J, Anderson T, et al
July 1979 29p APR7714533
NSF/RA-790231 PB80-106396/NKS

This report describes work performed during the second six-month period of a grant applied to advanced industrial robot control systems. The objectives are to improve the performance of industrial robots by developing a consistent theory and task description language. Work reported on includes the development of a simple joint motion control scheme to provide for the execution of structured robot task programs and to provide the capability of performing tasks on a moving conveyor, the integration of teaching into the task program, a direct on-line approach to the motion time optimization, and an approach to Cartesian motion control of a manipulator employing a fast, exact method.

1212. Local Search for the Asymmetric Traveling Salesman Problem
Massachusetts Institute of Technology, Laboratory for Information and Decision Systems
Kanellakis C, Papadimitriou CH
August 1979 29p ATR7612036, DAR7817826
NSF/RA-790232 PB80-118532/NKS

Application of tour-to-tour improvements (also known as neighborhood search or local search) to the asymmetric traveling salesman problem (ATSP) is reported. The traveling salesman problem can be formulated as follows: "Given a complete graph G = (V,E) and a weight C_{ij} for each directed arc (i,j) in E, find a Hamiltonian circuit (or tour) of G having minimum total weight." The ATSP involves important special cases of this general problem. Since ATSP is an NP-complete problem it probably is beyond practical computer solution. Hence an extension of the Lin-Kernighan local search algorithm was employed to solve the ATSP. Theoretical results pertinent to the local search are presented together with a heuristic for ATSP. Computational results strongly indicate that the algorithm used is suitable for the solution of very large instances of the ATSP. Theoretical results which guided the design of the heuristic are discussed as well as some other aspects of local search and ATSP.

1213. Generalized Manufacturing Simulator, a Users Manual for GEMS, Final Report, Version 2
Texas A & M University, Department of Industrial Engineering
Phillips DT, Handwerker M, Piumsomboom P
September 1979 228p APR7622610
NSF/RA-790233 PB80-108053/NKS

The Generalized Manufacturing Simulator (GEMS) User Manual provides overview of GEMS programs, organization, and operation.

The GEMS simulator currently consists of a small main program and 71 subroutine and function subprograms designed to simulate generalized manufacturing systems. An evaluation of GEMS network concepts and notations describes the box/mode/arc representations of physical systems. Another section deals with data input structure and program control, including namelist run, namelist par, namelist resin, namelist box, and namelist stat. Examples of GEMS models and useful data are presented. A separate section on the outlook for GEMS includes an illustrative example, a description of echo-check, and the output for two examples. Finally, error and warning messages that might be printed out during the execution of the GEMS program are listed and explained.

1214. Simulation of Numerical Control Operations Using GEMS, An Industrial Application, Final Report (Definition, Development and Implementation of a General Manufacturing Simulator, GEMS)
Texas A & M University, Department of Industrial Engineering
Goforth R, Sathaye S, Phillips DT
September 1979 62p APR7622610
NSF/RA-790234 PB80-116460/NKS

Forumlation of a prototype, micro-level GEMS model and the data generation used to simulate numerically controlled production matching operations are reported. GEMS is a complete simulation language capable of simulating generalized piece-part manufacturing systems. In the field test conducted at Hughes Tool Company in Houston, Texas, a prototype GEMS micro-level model was developed for use in machining of tool point pins. The micro-leveling concept is explained together with each step of the process including sample calculations required to develop input data. A probabilistic tool life model under variable operating conditions was developed along with a technique for selecting the most economical cutting conditions. The effects of changing such factors as operating parameters, tooling material and configuration, tool change policy and sequence of N/C machining steps on production cycle time, multipass operations, cost per component, machine loading, and part flow characteristics are detailed. The GEMS network is described along with results of seven computer simulation runs. The field study successfully demonstrated the industrial use potential for GEMS for simulating numerically controlled production machining operations.

1215. GEMS Model of a Tool Joint Manufacturing System: An Industrial Application, Final Report
Texas A & M University, Department of Industrial Engineering
Dharia V, Phillips DT
September 1979 156p APR7622610
NSF/RA-790235 PB80-116916/NKS

Applications of a Generalized Manufacturing Simulator (GEMS) model of the Tool Joint Division of Hughes Tool Company, Houston, Texas, are reported. This division comprises four shops which are production lines producing a family of tool joints having similar processing requirements. Models for these multi-stage, multi-product production lines were developed using actual operating data. Separate executable models for the constituent shops can be used to study them individually in detail. The models incorporate a variety of GEMS features including order generators, attribute assignment boxes, attribute holding times, queue ordering by attribute, probabilistic output boxes, and many others which demonstrate the flexibility and modeling capabilities of GEMS and enhance its value and applicability to manufacturing situations. The models were programmed and run with user interaction to provide valuable input and familiarize the user with GEMS features. Results obtained from a simulation analysis of the division as well as those from experiments conducted on models are reported.

1216. GEMS Model of an AS/RS Automated Warehousing, Distribution Center (Definition, Development and Implementation of a Generalized Manufacturing Simulator, GEMS)
Texas A & M University, Department of Industrial Engineering
Sathaye S, Phillips DT, Handwerker M
September 1979 51p APR7622610
NSF/RA-790236 PB80-113012/NKS

Use of a Generalized Manufacturing Simulator (GEMS) in various stages of an AS/RS warehouse system design is described. GEMS models were developed as a verification tool to study systems behavior under different input/output parameters and to verify system specifications. The schematic layout of a 15-aisle warehousing system used in this study contains three interrelated operational subsystems for input, storage retrieval, and output. A preliminary design network model, GEMS Model 1, for use in validation/verification is described together with the assumptions on which it is based. Parallel information is presented for GEMS Model 2, which is similar to GEMS Model 1 except for modifications to incorporate use of forklift trucks and identify products stored in each aisle. Results indicate that a designer using GEMS Model 2 can verify or attempt to optimize operational parameters. Experimental results with Model 2 illustrate the pitfalls of designing for the average. The final GEMS Model 2 system meets system specifications for the average output rate, but it cannot cope with sustained peak output rates.

1217. Magnetic Suspension for Rotating Equipment, Project Final Report, Phase I
Spin and Space Systems, Inc.
Reistad K, Ellison W, Yonkovich G
March 1980 119p DAR7916703
NSF/RA-800046 PB80-196272/NKS

Presented is a study which investigates the feasibility and design criteria for employing magnetic suspension in mechanisms intended for high rotational precision. Magnetic suspension is useful for applications requiring high-speed rotor pointing and/or speed control in high-precision instrumentation. The study includes a survey of magnetic suspension types and their basic characteristics. Attention is focused on control systems and magnetic circuit design and their interrelationships with the assembly structure and other components. Major results of the study include: (1) relationships for determining pole-piece, magnet, and control coil configuration, sizing, and material properties trade-offs; (2) identification of the nature and extent of needs for empirical design data; (3) extensive analysis of control gain and phase stability criteria, requisites of feedback elements, and compensation techniques; and (4) evaluation of rotor dynamics and prospective means for augmenting radial and angular stiffness and damping. Information gained is applicable to the design of static and linear suspensions as well as to high-speed applications. Advantages foreseen are increased drag, preclusion of wear degradation, and very low sensitivity to ambient disturbances. The report concludes that a magnetic suspension for rotor speeds exceeding 50k rpm and a skin axis accuracy of 0.1 arc second appear feasible.

1218. Microcomputer-Based Natural-Language Understanding, Final Technical Report, Phase I (October 1, 1979 - March 28, 1980)
Machine Intelligence Corporation
Rosen CA, Haas N
1980 48p DAR7917648
NSF/RA-800047 PB80-187370/NKS

This report summarizes research on the cost effectiveness of natural-language processing in support of industrial productivity. The primary goal was to assess the feasibility of creating inexpensive, microcomputer-based systems that allow industrial data bases to be accessed through queries expressed in ordinary English. Principal results of the project include: the development of a grammar for characterizing, in machine understandable form, a significant and habitable subset of the English language for use in building, updating, and querying data bases; the development of new, compact data structures for encoding grammatical rules and lexical information suitable for use with microcomputers; the development of an efficient parsing algorithm for natural languages, and its implementation in PASCAL; and the clear demonstration of the feasibility of microcomputer-based, natural-language processing as defined in the study.

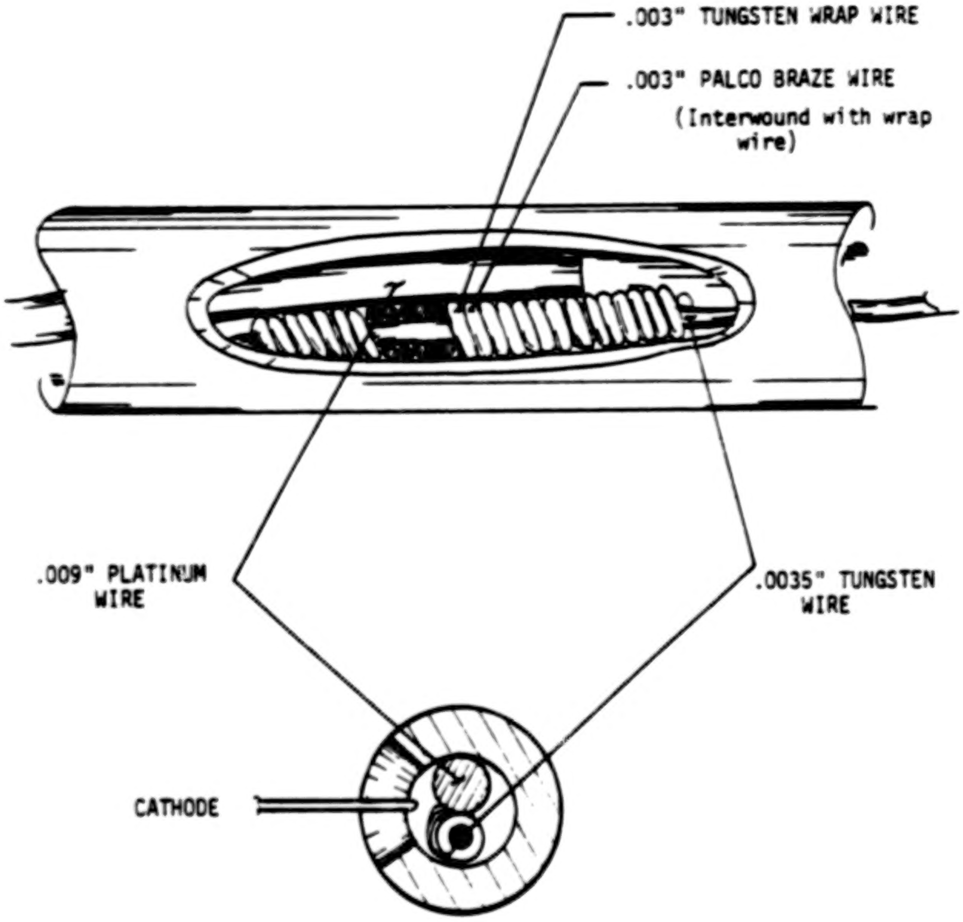


FIGURE 5.1 SCHEMATIC OF TUNGSTEN-PLATINUM JOINT

See Entry 1219.

1219. Mini-Arc Welding/Brazing Technique, Final Report
Amex Systems, Inc.
Cann GL
March 1980 68p DAR7917748
NSF/RA-800048 PB80-186497/NKS

This report describes feasible applications of the mini-arc technique to competitive electron beam welding, or spot welding. This involved establishing the physical principles and processes which occur in all methods of making metal-to-metal or metal-to-ceramic joints. Also, it entailed an analytical and experimental determination of size, power, and applicability limitations of the micro-arc process. The mini-arc welder precludes the need for flux or other chemical cleaning processes. It operates on several selected materials and configurations. Results were compared to those using electron beam and spot welding. The mini-arc proved superior, sometimes creating welds which other techniques could not match. The mini-arc technique can reduce fabrication costs for selected materials, and it is really suited for automation in manufacturing processes, especially those involving small dimensions. Because emphasis is placed on the low power, small size end of the heli-arc spectrum, the process is termed micro-arc technology.

1220. SlideStore Large Capacity Information Storage, Final Report
OMEX
Burns LL
1980 107p DAR7821344
NSF/RA-800049 PB80-187875/NKS

A large-scale optical mass memory suitable for government, industrial, and commercial use is researched. This report describes and illustrates the SlideStore feasibility model, which is based on the use of rectangular media for optical data recording by material ablation with a laser beam. The unit, shown in photogaphs, has successfully recorded raw data and read the data back in a manner that will be suitable for transfer to a host computer. Included in the report are descriptions of the model's potential market, the design guidelines, specifications, and media development, artists' conceptions of a 2000-slide version of SlideStore for archival information, a 6000-slide version, and a 10 to the 15th power SlideStore memory installation which uses nine 6000-slide SlideStore units as well as off-line storage of DataSlides.

1221. Recognition of Parts and Their Orientation for Automatic Machining, Handling, and Inspection, Final Report
L.N.K. Corporation
Stockman GC
March 1980 36p DAR7917088
NSF/RA-800051 PB80-178817/NKS

This report describes a technique whereby a flexible robot with vision can recognize a workpiece in various orientations and under certain background conditions of overlap and clutter. A registration technique developed previously to match aerial imagery to maps was tested for matching parts imagery to blue-prints. Primitive features were automatically extracted from the images and a set of vectors derived which represented real or abstract edges in the image. Each vector can be used to determine a unique rotation and translation mapping the image edge onto a model edge. A cluster formed in the space of all such mappings revealed a mapping that matches many edges of the part onto many edges of the model and thus the aspect of the imaged part is known. This registration technique was tested on images of carburetor covers and hinges. In general, the results were satisfactory with all types of imagery tested. In all but one case, at least one object in the image was correctly acquired.

1222. On-Line Direct Digital Control of Extrusion Processes
Scientific Process and Research, Inc.
Klein I, Klein R
April 1980 102p DAR7917508
NSF/RA-800052 PB80-186489/NKS

The study and evaluation of existing extrusive control systems in the plastics industry and an analysis of the merits of a new method of control are the primary objectives of this research. Initially, the term "extrusion control system" in relation to plastics processing operations included set point controls for various types of heating and cooling equipment as well as motor speed controls for DC and hydraulic screw drives. Special controls have now become available because of the advent of digital and microprocessor based electronic systems, machine sequencers for injection and blow molding lines, and feed back loops for sheet thickness and insulation uniformity. Many facets of the extrusion process are examined: the extrusion operation; analysis of existing control systems; directions for development of a new control system; program modules and linkages; and the alarm handler operation. It is concluded that adequate theoretical know-how exists to permit the construction of a fundamental model for any extrusion-based process irrespective of the plastics processed, the geometry of the equipment used, or the product that is made. Abstracts of technical papers used in the preparation of this study are contained in the appendix.

Applied Geophysical Sciences

1223. Comparative Cost of Near Surface and Deep Tunnels, Final Report
University of Illinois at Chicago Circle, Geotechnical Engineering Laboratory
Peters JF, Peck LG, Silver ML
June 1979 303p APR7600315
NSF/RA-790156 PB80-102403/NKS

Comparative cost estimates are presented for deep and shallow tunnels constructed under geologic conditions found in major U.S. urban areas. The cost data presented can be used in the predesign planning of tunnel systems for sewer, water, utilities, and transportation. Particular emphasis was placed on the potential for reducing the overall cost of tunnel projects in urban areas by placing tunnels at greater depths where geologic conditions are more favorable and disruption of the surface environment is avoided. The cost analyses were performed using COSTUN, a comprehensive computer program for estimating the cost of soil and rock tunnels. The geologic conditions assumed for the analysis were modeled after the known conditions in Atlanta, Boston, Chicago, Denver, and Los Angeles. Results of the cost comparison are: (1) the cost of deep underground heading tunnels is much more sensitive to different geologic conditions than is the cost of cut and cover tunnels; (2) for tunnel sizes less than 6 to 10m, deep rock tunneling is less expensive than cut and cover construction; (3) the cost difference between rock tunneling from underground heading and cut and cover construction decreases with tunnel size with the cost of both types of construction being nearly the same for tunnels in the 10 to 12m size range; and (4) the cost of underpinning, utility relocation, and surface restoration associated with cut and cover construction is extremely variable and can sometimes exceed the cost of the basic tunnel construction.

1224. Initiator Firing Times and Their Relationship to Blasting Performance
Martin Marietta Laboratories
Winzer SR, Furth W, Ritter A
1979 16p DAR7705171
NSF/RA-790158 PB80-104748/NKS

Commercially produced electric and nonelectric ms delay initiators, period 0-19 (0-1000 ms), from the four principal U.S. manufacturers were tested to determine mean and standard deviations of firing times. Deviations from nominal firing times given by the manufacturer were noted for all manufacturers' inititators. A predictive statistical model has been developed to describe the behavior of these initiators in actual practice. Application of the model to the test data reveals that the probabilities of successful shots (no sequencing errors and separation of adjacent periods by 8 ms or more) are low. Observations of production blasting operations in several aggregate quarries, using high-speed cinematography, confirm the results of the test and the statistical model in field practice. Relationships between deviations from nominal firing time and problems with relief, fragmentation, flyrock, and backbreak were established. In addition, data from the high-speed films suggest that currently used timing guidelines for designing properly relieved shots (1 ms/ft of burden) are too short and that delay times up to 3.5 ms/ft are needed. The low probabilities of success predicted by the model potentially affect vibration and airblast control.

1225. Correlation of the Material Properties of Tungsten Carbide Inserts with Drilling Performance in Hard Formations, Final Report, Phase I
Terra Tek
Cutler RA, Hendrickson RR, Lingle R, et al
January 1980 91p DAR7713273
NSF/RA-800010 PB80-164072/NKS

Twenty tungsten carbide (WC) mining grades with cobalt (Co) and nickel binders were tested to determine their physical and mechanical properties. Metallography and energy dispersive spectroscopy detected a WTiC phase in six of the grades. The presence of TiC significantly lowers the fracture toughness of the inserts. Grades containing nickel binders had lower abrasion resistance, crack resistance, and fracture toughness for a given hardness, when compared to WC-Co cermets. Six grades displaying a wide range of properties were selected for field testing during Phase II in order to correlate the properties of the inserts with their performance during drilling in taconite ore. Abrasion resistance, Palmqvist crack resistance, Rockwell A hardness, short rod fracture toughness, and transverse rupture strength measurements were used as the criteria for the selection of field test grades.

1226. New Instrumentation for Temperature Measurement, Phase I, Final Project Report
American Liquid Xtal Chemical Corporation
Fergason JL
1980 38p DAR7917642
NSF/RA-800037 PB80-184682/NKS

Research is presented on temperature-sensitive liquid crystal designed to meet the need for a device to accurately measure temperature and temperature distribution in the presence of electric, magnetic, and sonic fields, especially with high space and thermal resolution. A technique was developed to make highly reproducible, stable configurations of liquid crystal encapsulates. Temperature-stable sensors have been produced which can be calibrated to the National Bureau of Standards. These sensors do not react to very strong magnetic and electric fields, and the thermal properties of the liquid crystal can be matched to the properties of the surrounding medium. Since a two-dimensional representation of the temperature distribution is possible, the use of this instrumentation has significant implications for bioengineering. Thus, in monitoring local hyperthermia treatment, heating often is induced by microwaves or ultrasonic energy with measurements being made so as not to disturb local fields. This research has led to two inventions, one relating to new device configurations, and the other to the composition of matter for controlled stability.

1227. Biogeochemical Laboratory Studies to Establish the Spectral Properties of Mineral-Induced Stress in Plants, First Report
Columbia University, Aldridge Laboratory of Applied Geophysics
Collins W, Chang S-H, Kuo JT, et al
1980 74p DAR7816320
NSF/RA-800038 PB80-196769/NKS

Controlled laboratory experiments have successfully duplicated and verified subtle spectral properties observed over natural mineral deposits. This investigation stems from studies of natural geochemical anomalies observed in airborne spectral surveys of fresh covered mineral deposits. The airborne data contain considerable noise interference introduced by natural forest canopy variations, topography, atomospheric bands, etc. Field data are further complicated by uncertain ground control over both the geology and other canopy effects such as species. Near infrared absorption edge shifts related to metal stress are reproduced. The absorption edge becomes progressively steeper under metal-induced stress. Derivative and waveform analysis techniques are sensitive to observed frequency variations and insensitive to background intensity or scattering effects which in most cases constitute a noise problem. Laboratory results indicate that metals do not substitute into, or otherwise alter, the chlorophyll molecule. It is hypothesized that frequency shifts on the absorption edges probably result from changes in the electrostatic field environment of the _in vivo_ molecule.

1228. Detection of Hidden Mineral Deposits by Airborne Spectral Analysis of Forest Canopies
Columbia University, Aldridge Laboratory of Applied Geophysics
Collins W, Chang S-H, Kuo JT
1980 66p DAR7816320
NSF/RA-800041 PB80-193881/NKS

Field surveys and data analysis of four biogeochemical test sites confirm the ability of an airborne system with high spectral resolution to detect an anomalous spectral waveform that appears to be associated with sulfide mineralization. Sites studied include Cotter Basin, Montana; Spirit Lake, Washington; Blacktail Mountain, Montana; and Catheart Mountain, Maine. Known or suspected

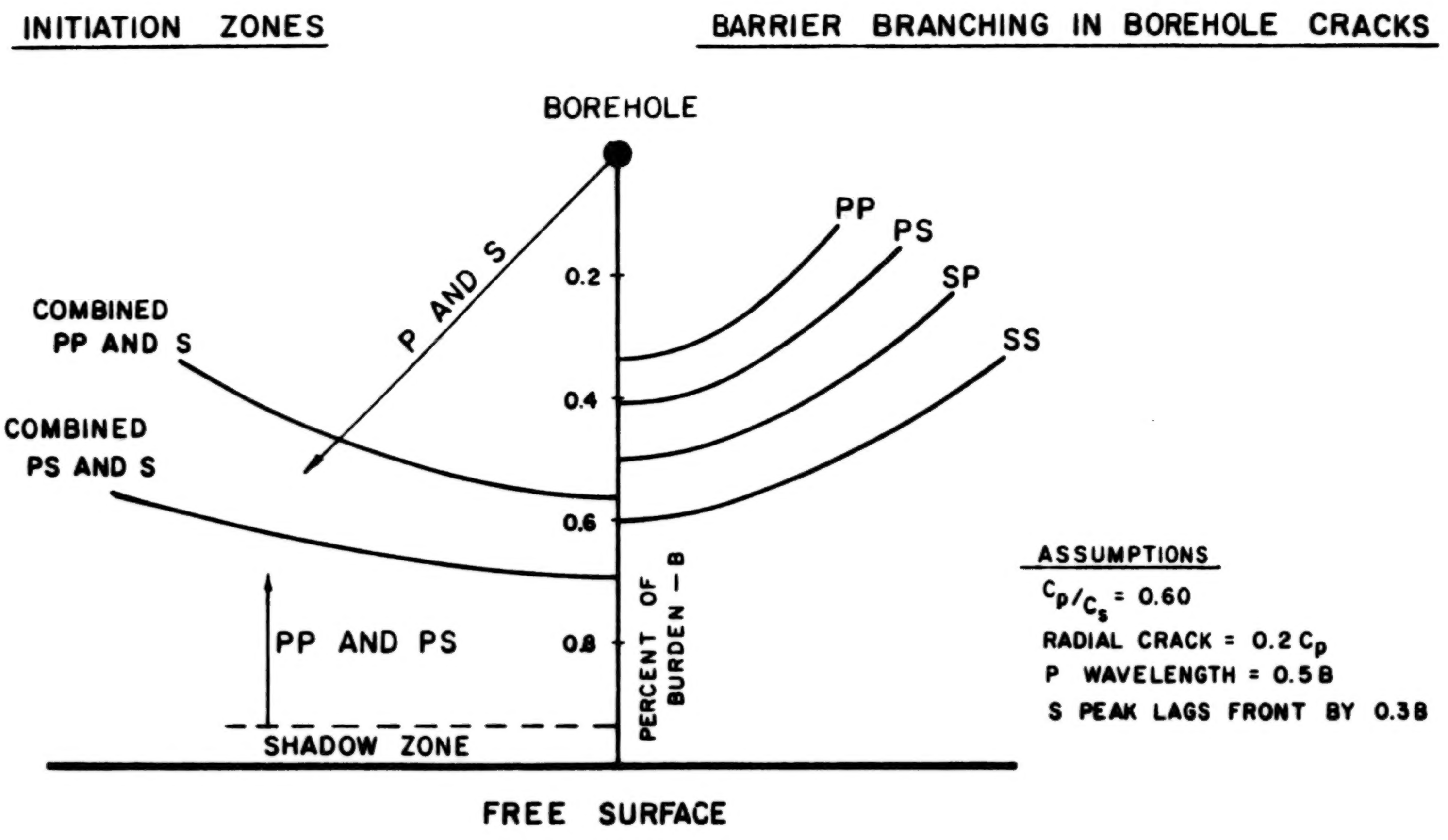


FIGURE 3. ZONES FOR NON-RADICAL CRACK INITIATION

See Entry 1230.

sulfide zones were detected on each site. Results correlate strongly with past observations that sulfide mineralization can affect overlying vegetation, thereby reducing anomalous spectral reflectivity properties. Complementary studies on laboratory grown plants confirm previously observed spectral effects and indicate that doping greenhouse plants with copper and zinc retards their development of chlorophyll pigments. Laboratory studies also demonstrate that present high resolution spectroradiometer instrumentation and waveform analysis offer the most sensitive methods of stress detection. A major problem in field data analysis is noise filtering induced by vegetation canopy and other environmental effects. Preliminary analyses assess the potential for using discrete spectral bands and imaging techniques to detect mineral-stressed vegetation.

1229. Computer Analysis of Seepage and Groundwater Response Beneath Tailings Impoundments
Waste and Land Systems, Inc.
Davis LA
April 1980 96p DAR7917109
NSF/RA-800054 PB80-178619/NKS

Research was undertaken to determine the possibility of using a computer model to estimate the seepage rates from tailings impoundments. The tailings must be disposed of in an evironmentally acceptable manner. Previous methods were modified and combined with an existing computer model for saturated groundwater flow. This computer program is capable of simulating seepage from the impoundment, groundwater response beneath the impoundment, and the effects of previous seepage on the calculation of the subsequent seepage rate. The model is general, allowing for spatial variations of hydraulic properties, complex impoundment geometry, and arbitrary initial conditions. The model analyzed a few simple problems and produced encouraging results and acceptable data requirements. Although additional testing and verification are needed, results indicate that the model developed can provide an effective tool for estimating seepage rates from tailings impoundments and, with modification, can aid designers of impoundments.

1230. Improvements in Efficiency for the Quarry Industry: An Investigation into Delay Blasting
University of Maryland, Mechanical Engineering Department
Fourney WL, Barker DB, Holloway DC
February 1980 52p DAR7705171, DAR7818008
NSF/RA-800056 PB80-178296/NKS

Addressed is an experimental program designed to determine the role of stress waves in a flawed media. The aim is to provide a more accurate representation of the fundamental mechanisms of rock fragmentation due to the detonation of explosives. The program uses dynamic photelasticity, dynamic holography, and high-speed photography in laboratory models of plastics and rocks. Fragmentation mechanisms are first identified for homogeneous models of infinite extent and then for situations in which boundaries are in close proximity to detonated boreholes. Large block testing of limestone samples was conducted. It was discovered that inaccuracies existed in times of detonation of blasting caps commercially manufactured in the U.S. The study identifies a new mechanism of fragmentation traceable to the shear component of stress in the outgoing compressive wave peak. This mechanism could account for much of the fragmentation that occurs in a quarry blasting operation.

Chemistry and Chemical Applications

1231. Recovery, Re-Use, and Reduction of Zinc Metal Waste in Zinc-Rich Primers, Final Report
University of Louisville, Government Law Center
Plock EV
January 1979 196p AER7709449
NSF/RA-790174 PB80-101504/NKS

Development of mechanisms to re-use zinc wastes in zinc-rich primers is reported. Rapid expansion in the use of zinc-rich primers for protective coatings is sharply increasing the volume of waste zinc, which amounts to over 50 percent of the amount used in this type of application. Newly developed processes are described to recycle all current and future waste zinc from national zinc-rich primer production. A major industrial model has been structured and implemented for high percentage zinc wastes. Corollary research has developed an electrolytic spraying system which greatly reduces the quantity of zinc primer wastes. Other zinc waste reduction studies led to the development of methods which extend the life of zinc coatings or partially replace zinc with diluents. The feasibility of using zinc primer wastes in fertilizers, zinc-rich primers, concrete coatings, zinc smelter feedstock, and zinc oxide manufacture is discussed.

1232. Mineral Resources Science and Technology, Project Summaries
National Science Foundation, Engineering and Applied Science Directorate
February 1980 33p
NSF/RA-800006 PB80-197353/NKS

This report is a compilation of 39 abstracts of applied research projects in the area of minerals processing and extractive technologies. One of the specific objectives of the Applied Research Program in the Engineering and Applied Science Directorate is to identify and support high-risk, frequently interdisciplinary research aimed towards new processes and technologies for improving the efficiency of separation of minerals and extraction of metals from low-grade ores and process wastes. In addition to the abstract the following information is given: project title, grant number, principal investigator, performing organization, grant duration, amount awarded, report number, and availability, if any. Some of the subjects covered in this report include research on zinc, copper, lead, cobalt, chromium ores, phosphatic slime, ion ore availability, metal recovery, magnetic separation, the mechanism of flocculation, the solution mining process, bacterial leaching, and flotation separation technology.

Applied Biology and Biological Applications

1233. Identification and Economic Feasibility of Agricultural Management Practices Which Mitigate Salinity Impacts on Arid Lands Agriculture, Final Report
Great Western Research, Inc.
Kleinman AP
March 1980 58p DAR7917487
NSF/RA-800059 PB80-201312/NKS

The primary objective of this study was to estimate the costs and benefits of on-farm salinity mitigation measures. Continued addition of irrigation water to the soil adds salts that may accumulate sufficiently to reduce plant growth and crop yields. Literature review and personal interviews with irrigation specialists, agriculturalists, and farm operators were carried out to ascertain the range of impacts associated with alternative management practices. Where possible, the technical relationship of each promising management practice was defined relative to yield with an associated estimate of benefits. The cost of implementation was then compared to determine economic feasibility. Of the 20 management practices examined, eight were judged to be technically valid and economically feasible for mitigating salinity in irrigated agriculture. The cost effective options and estimated benefit-cost ratios are: (1) soil additives - 1.47; (2) leaching irrigations - 1.91; (3) underground drains - 1.89; (4) lower ground-water table - 3.04; (5) increasing irrigation frequency - 1.35; (6) sprinkler irrigation - 1.41; (7) special bedding practices -1.84; and (8) special planting practices - 2.96. Results indicate that adequate management options are available to farmers to mitigate a great portion of the damage from salinity in both water and soil.

Applied Physical Sciences

1234. Tunable Laser Survey of Molecular Air Pollutants, Doppler-Limited Spectra of the C-H Stretching Bands of Formaldehyde, Ethylene, Ethane, and Allene, Final Report
Massachusetts Institute of Technology
Pine AS
January 1980 145p DAR7824562
NSF/RA-800011 PB80-180003/NKS

High resolution (Doppler-limited) near-infrared spectra of several hydrocarbons and other light molecules of atomospheric significance were surveyed and catalogued using a unique difference-frequency laser spectrometer. Such spectra can be applied to the detection, identification, and quantitative monitoring of molecular air contaminants using lasers or other high-resolution spectroscopic instruments. Presented here are the complete Doppler-limited spectra of the complex and rich C-H stretching bands of formaldehyde (H_2CO), ethylene (C_2H_4), ethane (C_2H_6), and allene (C_3H_4). Precise frequencies and intensities of the spectral lines also are listed in an atlas for each molecule along with assignments, made by several collaborators, for most of the observed transitions.

Applied Earth Sciences

1235. Managnese Metal: Its Metallurgical Applications and Markets, Proceedings of a Conference (Massachusetts Institute of Technology, May 4, 1978)
Massachusetts Institute of Technology, Department of Materials Science and Engineering
Black JRH, Clark JP, Grant NJ, eds
May 1978 106p AER7707913
NSF/RA-790115 PB80-106453/NKS

This conference investigated the potential for new manganese base alloy systems and for increased use of manganese in already existing systems. Papers directed toward manganese alloy developments occurring in the past, in both the ferrous and nonferrous areas, address the potential for commercial development of these manganese base alloys and the applications for which they would be suited. Other papers deal with the feasibility of obtaining manganese from deep sea nodules and pursuing the market most likely to utilize large quantities of maganese. An overview describes the supply of maganese available from different sources and the outlook in the demand for manganese products, particularly electrolytic manganese and ferromanganese.

1236. Computer-Based Consultant for Mineral Exploration, Final Report
SRI International
Duda RO, Hart PE, Konolige K, et al
September 1979 191p AER7704499
NSF/RA-790228 PB80-106347/NKS

This report summarizes the results of a two-year program of research on the Prospector system--a set of computer programs to provide consultation services for mineral exploration. The heart of the system is a group of specially encoded models of different classes of ore deposits. Such models can be used for several purposes, including (1) evaluation of a particular exploration site, (2) evaluation of drilling targets in that site, (3) regional resource evaluation, and (4) informal education about each class of deposits modeled. Eight prospect-scale models, two drilling-scale models, and one regional-scale model have been developed, and their current status is summarized. Detailed technical accomplishments during the past six months are described in appendices on a particular ore deposit model, the control strategy for the program, a new method for probabilistic computations, and a new knowledge acquisition system.

DIVISION OF PROBLEM-FOCUSED RESEARCH (PFR)

Alternative Biological Sources of Materials

1237. Evaluation of Cellulose Sources for Unconventional Nutritional Uses, Final Report
University of Missouri at Columbia, Department of Chemical Engineering
Dunlap CE
February 1979 305p AER7617912
NSF/RA-790166 PB80-103922/NKS

Development of a standard assay technique and its application in measuring the nutritional quality of various cellulosic materials are described. About 30 different sources of cellulose were collected for testing and evaluation. Cellulose availability and composition were studied. The major criteria used to identify promising cellulose sources were availability, cost, and quality. On those bases, nine materials were selected for potential use in unconventional nutritional applications. The search for and design of a standard test or assay technique for measuring the nutritional quality of cellulosics resulted in the selection of a controlled digestion using cellulase enzymes as hydrolytic degrading agents. Hydrolysis was monitored by weight loss of substrate or production of reducing sugars. This assay technique was applied to the nine selected cellulosics in untreated state. Differences among the materials were clearly distinguishable. Data thus obtained were used to design a mathematical model for predicting operating characteristics for a continuous flow hydrolysis system. Use of the model provides a standard basis for comparing the nutritional value of various cellulose sources.

1238. Assessment of Bacteria for Lignocellulose Transformations, Final Technical Report
University of Minnesota, Gray Freshwater Biological Institute
Crawford RL
1979 6p AER7622254
NSF/RA-790217 PB80-108681/NKS

In this research approximately 50 eubacteria were isolated and screened for their abilities to convert ^{14}C-(LIGNIN)-lignocelluloses to $^{14}CO_2$. Nine of the bacteria were able to perform the conversion. The best lignin-degrading bacterium isolated was a Bacillus strain isolated for its ability to degrade corn-stalk lignocellulose. That organism has been deposited in the American Type Culture Collection (ATCC 33000). During the investigation, methodologies for the study of lignin biodegradation have been improved significantly, preparing the way for laboratory-scale attempts at bioconversion of lignocellulosics to useful commodities and genetic manipulation of bacteria to improve their lignocellulose-transforming capabilities.

1239. Prehydrolysis of Sweetgum Wood, Phase 1, An Integrated Approach to the Conversion of Lignocellulose from Wood into Useful Chemicals, Summary Report
North Carolina State University, Department of Wood and Paper Science
Scaringelli FP, Strouse BA. Goldstein IS
June 1979 38p PFR7712243
NSF/RA-790218 PB80-108640/NKS

The prehydrolysis of sweetgum wood was studied at acid concentrations of 20 percent and 30 percent HCl over the temperature range 30-60°C. The reactions were followed by weight loss of the wood and xylose formation. Primary and secondary reactions were detected by both techniques. The rate constants for the primary reactions are almost identical. The slower secondary reactions represent different processes; for xylose formation the secondary reaction represents hydrolysis of 4-0-methylglucuronylxylose liberated by cleaveage of the xylan backbone during the primary reaction. In sweetgum, approximately every third xylose molecule in the xylan backbone is substituted with 4-0-methylglucuronic acid. Graphical plots and an equation have been derived, allowing estimation of the primary reaction rate at other temperatures and acid concentrations. Maximum yields of furfural can be obtained from 67 percent conversion of the xylan to xylose in less than one hour at acid concentrations in excess of 30 percent HCl and reaction temperatures of about 30°C, since the remaining xylose is liberated under the furfural reaction conditions.

1240. Chemical Synthesis and Biological Applications of Nucleic Acids to Nitrogen Fixation (Semiannual Progress Report No. 4, January 16 - July 15, 1979)
Collaborative Research, Inc.
July 1979 25p AER7710195
NSF/RA-790220 PB80-122393/NKS

Progress in developing new methods of oligonucleotide synthesis which utimately will be applied to nitrogen fixation gene transfer problems is reported. Feasibility of the phosphite method to synthesize long chain defined sequences was investigated together with more efficient methods for large-scale production of monomers. The necessary monomers have been prepared and used in the large-scale synthesis of dimer blocks. Attempts to synthesize a hexamer and elevenmer yielded complicated reaction mixtures. Future attempts to conduct large-scale condensations via the phosphite approach will be carried out in a controlled atmosphere. The research also involved development of a solid phase support synthetic method. A suitable polymeric resin and silicyl leash was synthesized and used to bind nucleotides. Experimental methods and synthesis equations are included together with problems for future research.

1241. Isolation of Lignocellulose Transforming Microbes (Third Six-Month Progress Report, February 15 - August 14, 1979)
University of Wisconsin-Madison, Department of Entomology
Morris DM
1979 15p AER7708279
NSF/RA-790222 PB80-118441/NKS

Research on the isolation and identification of ectosymicotes which degrade lignin into substances, including appetite stimulants, is reported. Principal highlights include: (1) demonstration that a strain of *Fusarium solani*, a major ectosymbiote of ambrosia beetles, alters lignin model compounds by sidechain oxidation; (2) the degradation of the lignin in sound hardwood substrate under several *in vitro* conditions caused by a fungal ectosymbiotic strain associated with the beetle, *Dendroctonus pseudotsugae*; (3) extensive field research programs conducted to isolate new strains of ectosymbiotic microbes from three species of ambrosia beetle; and (4) prototype multi-species microbial systems to convert lignin of standard hardwood substrate into simple phenolics that stimulate the appetite of domesticated animals and also yield high protein microbial mass for use as animal feedstuffs.

1242. Enzymatic Transformations of Lignin (Summary Report, January 1, 1978 - June 30, 1979)
Virginia Polytechnic Institute and State University, Department of Chemistry
Hall PL
1979 18p AER7611050
NSF/RA-790223 PB80-118458/NKS

Research efforts in the areas of biochemical engineering, enzymology, and lignin chemistry and an analysis of enzymatic transformation of lignin are reported. Biochemical engineering investigations of microbial metabolism on lignin were studied. Multi-stage fermentations suggested that cells grown on malt growth in absence of lignin are best able to degrade lignins. Metabolic regulation of hydrolytic activity was studied with respect to the effect of nitrogen concentration. Enzymology research involved a continuing search for lignolytic enzymes, including the inhibitory effect of "DIECA," and a study of lignin-protein association interactions. Other experiments examined the action of HRP, xanthine oxidase, and potassium superoxide on kraft lignin, new lignin analysis techniques, and a new synthesis of sidechain labeled coniferyl alcohol for use in enzyme and microbiological studies. Lignin chemistry and analysis projects focused on development and application of analytical techniques to delineate lignin's structure.

1243. Microbial Control of Insect Pests, Future Strategies in Pest Management Systems, Selected Papers from NSF-USDA, University of Florida Workshop (Gainesville, Florida, January 1978)
University of Florida, Department of Entomology and Nematology
Allen GE, Ignoffo CM, Jaques RP, eds
1978 298p AER7706515
NSF/RA-790227 PB80-113806/NKS

This report consists of selected papers presented at a workshop to explore the state of the art of interacting arthropod pests and their pathogens and to encourage future research in evaluating the potential of manipulating entomopathogens in Integrated Pest Management programs. The papers are divided into four sections. The first, "Concepts to Increase Effectiveness," includes an introduction to and colonization of entomopathogens, induced epizootics, autodissemination of entomopathogens, manipulation of the environment, and application technology. The second, "The Role of Entomopathogens in Pest Management Systems," reports a panel discussion. The third, "Use of Entomopathogens in Pest Management Systems," concerns row crops, rangelands and pastures, aquatic ecosystems, fruit crops, ornamentals in the urban community, stored-product insects, and forest ecosystems. In the final section, on analysis and recommendations, concepts and strategies are discussed.

1244. Biological Systems for Lignocellulose Conversion (Seventh Progress Report, August 1, 1979 - January 31, 1980)
University of Wisconsin, Department of Bacteriology
Zeikus JG, Kirk TK
1980 111p AER7522789, PFR7910084
NSF/RA-800061 PB80-196751/NKS

Microbiological approaches to the utilization of lignocellulosic biomass are reported. The two biological systems examined were Phanaerochate chrysosporium and Clostridium thermocellum. Detailed studies of lignin metabolism by P. chrysosporium and of cellulose metabolism by C. thermocellum were undertaken. Specific tasks in the studies of lignin metabolism included (1) determining amino acid pools and total protein in cultures of P. chrysosporium on the culture's shift from pre-ligninolytic to ligninolytic (primary to secondary metabolic); (2) comparing the kinetics of suppression of ligninolytic activity by nitrogenous compounds with that caused by the protein-synthesis inhibitor cycloheximide, in ligninolytic cultures of P. chrysosporium; and (3) attempting to trigger early appearance of ligninolytic activity in cultures of P. chrysosporium using proteases or protease-inducers, thereby evaluating the possibility that proteases provide the connection between the onset of lignin degradation and nitrogen starvation. In the studies on cellulose metabolism, the extracellular cellulose activities of C. thermocellum and Trichoderma viride were compared. The relationship between ethanol yields and catabolic enzyme activities of C. thermocellum and Thermoanaerobium brockii was determined.

A thermophilic co-culture that ferments both hemicellulose and cellulose to ethanol in high yield was established.

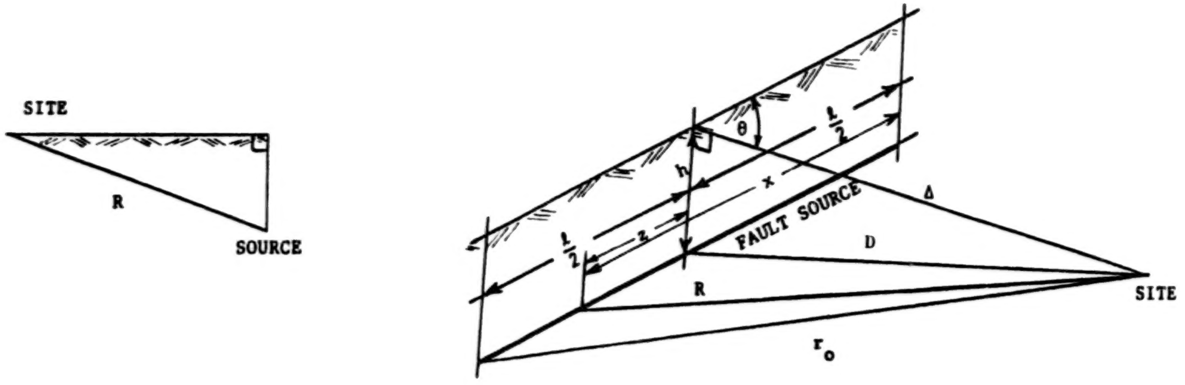
Earthquake Hazards Mitigation

1245. Earthquake Waves in a Random Medium
Princeton University, Department of Civil Engineering
Chu L, Askar A, Cakmak AS
June 1979 46p ENV7620027
NSF/RA-790127 PB80-104862/NKS

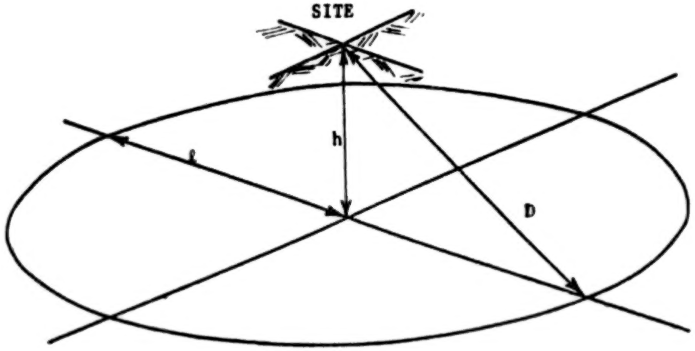
When measurements of earthquake waves are conducted with small samples in the laboratory, for all practical purposes the medium is macroscopically homogeneous. On the other hand, the uncertainties and the irregular changes in situ are macroscopic inhomogeneities. The work described is an attempt to account for stochastic changes in elastic properties and density in a rational manner. The method used is that of Karal and Keller, which is based on the use of the Green's function and neglect of third-order correlations. The resulting integral equations are solved by Laplace transform. The analysis indicates that the energy decay in the mean motion through random mode coupling introduces damping into even a purely elastic medium and enhances the damping in a significant manner in a hysteretic viscoelastic medium. This consideration is important in relating the damping and dispersion characteristics of waves in situ to those measured in the laboratory. The formulation is extended to multilayer systems through transfer matrices and to arbitrary inputs by Fourier transform. Sample calculations are presented for single and multilayer systems to obtain response spectra and for the response to Gaussian and actual earthquake motions.

1246. Probabilistic Seismic Stability Analysis - A Case Study
Rensselaer Polytechnic Institute, Department of Civil Engineering
A-Grivas D, Nadeau G
July 1979 42p ENV7716185
NSF/RA-790131 PB301291/NKS

The study provides an application of a probabilistic seismic stability analysis to a natural slope located near Slingerlands, New York. A detailed description of the model used can be found in a previous report of this series. The safety of the slope is measured in terms of its probability of failure rather than the customary factor of safety. Three types of earthquake sources are investigated--a point, a line, and an area source, and the dependence on significant seismic parameters of the probability of failure of the slope is examined. On the basis of the results obtained, it is concluded that the model is useful in assessing the reliability of soil slopes



(a) Point Source (cross-section) (b) Line Source (perspective)



(c) Area Source (perspective)

FIGURE 6. SCHEMATIC REPRESENTATION OF THE THREE EARTHQUAKE SOURCES

See Entry 1246.

under static and seismic conditions, and the probability of failure of a soil slope is greatly affected by the type of the earthquake source involved and by the values of seismic parameters associated with it.

1247. Analytical Method for Determining Seismic Response of Cooling Towers on Footing Foundations, First Interim Report
Washington University, School of Engineering and Applied Science
El-Shafee O, Gould PL
September 1979 228p PFR7900012
NSF/RA-790165 PB301308/NKS

A finite element model was developed to analyze shells of revolution under dynamic loading with soil-structure interaction effects. The model consists of high-precision rotational shell finite elements, representing the axisymmetric shell, supported on an equivalent boundary system, representing the soil medium. The substructure method is used to model the shell and soil components. In addition to the seismic analysis capability of the proposed model, it is also applicable to other dynamic loads such as wind. The dynamic behavior of a hyperboloidal cooling tower is studied using the proposed model. Dynamic properties are studied and stress analysis is carried out for a variety of soil conditions. The appendices include high precision rotational shell elements, details of stiffness matrix for an isoparametric solid element, a listing of the SUBASE Program, and modifications and additions for the User's Manual of the SHORE-III Program.

1248. Probabilistic Analysis of Temperature Loads for Structures (Structural Loads Analysis and Specifications Project)
Massachusetts Institute of Technology, Department of Civil Engineering
Millman P, Kilcup R, Cornell CA
June 1979 211p ENV7300345
NSF/RA-790179 PB301415/NKS

Three methods are presented for the probabilistic analysis of temperature effects in building elements. All three methods are applied to a simple one-dimensional temperature model which could represent a building wall element. The first method is a finite difference solution of the governing differential equation with an actual temperature record as input. The average strain and curvature in the wall element are calculated from the temperature distribution in the wall, and the mean upcrossing rate of different temperature levels is recorded. In the second method, the temperature record is characterized in the frequency domain by a power spectral density function. The temperature record is decomposed into the sum of a deterministic variation and a Gaussian random process. The third method uses a simplified approach in which it is observed that the average strain and curvature in a wall are similar in effect to a time-averaging filter applied to the temperature record. A procedure is presented to find an appropriate averaging time to apply to the temperature record to match the crossing statistics of the strain or curvature process.

1249. Baseline Correction of Earthquake Records in the Frequency Domain
Massachusetts Institute of Technology, Department of Civil Engineering
Kausel E, Ushijima R
July 1979 85p ENV7718339
NSF/RA-790180 PB80-102056/NKS

Various integration schemes for discrete functions in the frequency domain are established, and procedures are developed to perform a parabolic baseline correction to earthquake records in that domain. Only for acceleration records having zero mean value over the interval of definition does the simplest integration scheme analyzed (the "pseudo-continuous method") coincide with the "integration" procedure of dividing the Fourier Transform of the record by $\Omega\sqrt{-1}$. Records with no-zero mean require additional terms to achieve consistency with such time domain procedures as trapezoidal rule.
In the last section of the report the formulae developed are applied to the Golden Gate Earthquake of March 22, 1957, and compared against each other.

1250. Mechanical Behavior of Lightweight Concrete Confined by Different Types of Lateral Reinforcement (EERC-79/05)
University of California at Richmond, Earthquake Engineering Research Center
Manrique MA, Bertero VV, Popov EP, et al
May 1979 123p ENV7604263
NSF/RA-790183 PB301114/NKS

Results are given of an experimental study to evaluate the different aspects of the behavior of lightweight concrete. The study focuses on the behavior of confined lightweight concrete when subjected to axial, monotonic loading. The effects on confined concrete of the following parameters were considered: (1) concrete cover; (2) longitudinal reinforcement; and (3) lateral reinforcement arrangement. Thirty confined and unconfined specimens were tested. The effects of the mentioned parameters are evaluated and the experimental results are compared with the results of a similar investigation carried out on normal weight concrete. An analytical stress-strain relationship for longitudinally reinforced confined lightweight concrete is presented. Practical design implications of the study are presented.

1251. Cyclic Loading Tests of Masonry Single Piers, Volume 3, Height to Width Ratio of 0.5
University of California at Richmond, Earthquake Engineering Research Center
Hidalgo PA, Mayes RL, McNiven HD
May 1979 154p ENV7604265
NSF/RA-790185 PB301321/NKS

This report presents the results of 18 cyclic, in-plane shear tests on fixed ended masonry piers having a height to width ratio of 0.5. These 18 tests form part of a test program consisting of 80 single pier tests. Previous reports have presented the results of 45 piers having height to width ratios of 2 and 1, and a subsequent report will present the test results of the remaining 17 piers. The test setup was designed to simulate, insofar as possible, the boundary conditions the piers would experience in a perforated shear wall of a complete building. Each test specimen was a full-scale pier 40 inches high and 80 inches wide. Three types of masonry construction were used: a hollow concrete block and a hollow clay brick type that used an 8-inch wide unit, and a double wythe grouted core clay brick, 10-inch thick wall that consisted of two wythes 3 1/2 inches thick and a 3-inch grouted core. The variable included in the investigation was the quantity of horizontal reinforcement. All of the piers were fully grouted. The results are presented in the form of hysteresis envelopes, graphs of stiffness degradation, energy dissipation and shear distortion, and tabulated data on the ultimate strength and hysteresis indicators. A discussion of these test results is presented, but no definitive conclusions are offered. These will be included in a final report at the completion of the 80 tests.

1252. Seismic Behavior of Reinforced Concrete Interior Beam-Column Subassemblages (EERC-79/14)
University of California at Richmond, Earthquake Engineering Research Center
Viwathanatepa S, Popov EP, Bertero VV
June 1979 201p AEN7307734, ENV7604263
NSF/RA-790186 PB301326/NKS

This report presents details of experiments to test the seismic behavior of reinforced concrete subassemblages carried out on beam-column subassemblages, and evaluates the significance of the anayltical and experimental results obtained. Two virgin concrete subassemblages and one repaired subassemblage were tested. A horizontal force was applied to one subassemblage to generate a large single hysteretic loop, the initial part of which provided information on monotonic loading. Once the loading sequence was completed, this specimen was repaired by epoxy injection processes, and an incremental cyclic load was applied until failure occured. The second specimen was tested to failure by applying a similar loading sequence to that applied to the repaired subassemblage.

1253. On the Scale of Fluctuation of Random Functions
Massachusetts Institute of Technology, School of Engineering
Vanmarcke EH
April 1979 64p ENV7619021, PFR7815898
NSF/RA-790199 PB80-107865/NKS

New results are presented for the average crossing rate and for the probability distribution of extremes of moving averages or integrals of random processes that are ergodic in the mean. The results are asymptotically exact when the averaging time grows to infinity and provide excellent approximations for all but very small averaging times. The report provides new perspectives on the unifying role of the Gaussian random process toward which any stationary random process converges through "local" averaging or integration. The scale of fluctuation θ_x is identified as a key parameter of any stationary random process x(t). It is formally defined in terms of the variance of function, but it has simple interpretations in terms of the auto-correlation function and the spectral density function. The report shows how the scale of fluctuation can be derived for filtered random processes and for sums of random processes, and how it can be estimated from sample functions. It also demonstrates that results of the theory of interpolation and extrapolation of random functions can be simplified and made more useful by reinterpretation in terms of the scale of fluctuation. Specifically, it is found that by sampling a wide-band stationary random process x(t) at regular time intervals $\Delta t=\theta_x/2$, and by using the sampling theorem to interpolate between observations, the uncertainty about x(t) can be almost completely eliminated.

1254. Resonance Zones on the Surface of a Dipping Layer Due to Plane SH Seismic Input
Weidlinger Associates, Consulting Engineers
Wojcik GL
January 1979 99p PFR7815049
NSF/RA-790200 PB80-107907/NKS

This is an analytical study of the local effects of lateral geologic inhomogeneity on surface ground motion during earthquakes. The model is a surface dipping layer overlaying a halfspace, with plane SH waves incident from the halfspace in the downdip direction. Surface motion over the layer is calculated for transient (time domain) and harmonic (frequency domain) inputs. In the frequency domain constructive interference on the surface produces a standing wave pattern with spatial zones of resonance where translational motion is on the order of 6-15 times more than if the dipping layer were not present. Rotational motion is amplified to a greater extent, on the order of 20-50 times, and relative motion between spatially separated points, on the order of 10-20 times. The amplification mechanism is total reflection of multiple reflected plane waves between the free surface and halfspace. In the time domain, a transient input is converted to a series of transients on the surface. Depending on the natural frequency and location of the layer, structural or instrument response to a transient input is amplified to the same degree that surface motion is amplified in the frequency domain. An extension of the analysis, suitable for Love wave excitation, is described. Applications include seismic zonation, critical facility siting, building rehabilitation, and ground failure.

1255. Static Analysis of an Embedded Pipe Subjected to Periodically Spaced Logitudinal Forces, Grant Report No. 12
Weidlinger Associates, Consulting Engineers
Parnes R
August 1979 23p PFR7815049
NSF/RA-790201 PB80-105273/NKS

The dynamic response of buried pipelines to earthquakes is best expressed in terms of dynamic amplification factors, i.e., as the ratio of dynamic to static response. In this report, the required static response of pipes of diameter D subjected to periodic longitudinal forces at intervals L, acting in alternate directions, is obtained. Such a load pattern corresponds to the incoherent motion occurring in pipes due to earthquakes. The static displacements and interacting stresses of a pipe-soil system are established and are found to be dependent, for a given soil, on the ratio of stiffness of the soil and pipe as well as on the aspect ratio D/L. Numerical results for a series of pipes governed by the nondimensional parameters mentioned above are presented .

1256. Dynamic Response of an Embedded Pipe Subjected to Periodically Spaced Longitudinal Forces, Grant Report 13
Weidlinger Associates, Consulting Engineers
Parnes R, Weidlinger P
August 1979 34p PFR7815049
NSF/RA-790202 PB80-102932/NKS

The dynamic response of pipe systems buried in soil is studied. The degree of interaction between the pipe and surrounding soil as well as the amount of damping is established for pipes subjected to incoherent motion. The model considered is represented by a pipe of diameter D subjected to time-harmonic longitudinal forces acting periodically at intervals L in alternating directions. Such a loading pattern corresponds to the incoherent component of earthquake excitation. The pipe and the soil are assumed to behave as linear isotropic elastic materials, and the interaction between the surrounding soil and pipe is assumed to occur through a shear force mechanism acting at the pipe-soil interface. The response is found to be expressible in terms of non-dimensional ratios of density, velocity of wave propagation, and the aspect ratio D/L of the pipe. Results are presented in terms of dynamic amplification factors for various applied frequencies of the applied forces. Peak response and resonant frequencies are determined, and regions where radiation damping occurs are established. By choosing the suitable values of the governing parameters judiciously, the response can be obtained either for a continuous pipe or for an infinite train of pipe segments, interconnected by elastic joints at intervals L.

1257. Aseismic Design Procedures for Reinforced Concrete Frames
(Seismic Behavior and Design of Buildings), Report No. 1
Massachusetts Institute of Technology, Department of Civil Engineering
Biggs JM, Lau WK, Persinko D
July 1979 90p ENV7714714
NSF/RA-790205 PB80-104128/NKS

Twelve reinforced concrete frames are designed for earthquake and gravity loads using three different procedures for determining the seismic design loads. The procedures are (1) UBC static load approach, (2) modal analysis using inelastic response spectra, and (3) Substitute Structure Method. The frames are of 4, 8 and 10 stories. The validity of each design procedure is evaluated by time-history analysis of each frame to determine maximum local ductility demands due to both real and artificial ground motion. None of the three methods is found to be completely satisfactory because the ductility demands are not the same as intended in the design and are not evenly distributed over the frame. However, the computed ductility demands are in no case large enough to indicate structural collapse; in this sense all three methods produce satisfactory designs. Although the inelastic response spectrum approach produces slightly better results, the two more sophisticated methods do not produce significantly better designs than the simpler UBC approach.

1258. Computation of Hankel Transorms Using the Fast-Fourier Transform
Algorithm
Massachusetts Institute of Technology, Department of Civil Engineering
Kausel E, Bouckovalas G
August 1979 49p ENV7718339
NSF/RA-790206 PB80-104045/NKS

An efficient numerical procedure for the computation of Hankel transforms is presented. The algorithm is based on the expression of the Hankel Transform in terms of a two-dimensional Fourier Transform, which is then reduced to only one dimension. The latter is then evaluated with the Fast Fourier Transform algorithm. Examples are presented, and a listing of the computer program included.

1259. Natural Disaster Mitigation Research, Proceedings of the Indo-U.S.
Workshop on Natural Disaster (Earthquake and Wind Effects)
Mitigation Research (New Delhi, India, December 13-16, 1978)
California Institute of Technology
Hudson DE, ed
1979 68p EAR7805355
NSF/RA-790211 PB80-108277/NKS

Workshop proceedings on cooperative programs of India and the United States which involve safeguarding life and property from destructive effects of natural hazards (earthquakes and wind storms) are summarized. The following projects for collaborative research were agreed upon: (1) establishment of a strong motion earthquake instrument array and analysis of strong motion data in the Shillong region of Assam, India; (2) investigation of methods for designing earth and rock-fill dams for earthquake motions; (3) study of generation of strong earthquake type ground motion by high explosive arrays; (4) research in various aspects of wind engineering, including measurement of wind speeds in severe tropical storms, risk analysis, preparation of wind zoning maps, and study of wind effects on structures; (5) consideration of areas of mutual interest in strengthening masonry buildings to withstand earthquake forces; and (6) independent creation in India of a shaking table facility of reasonable size with capacity for programmed vibrations simulating earthquake ground motion.

1260. Strong Ground Motion, N.S.F. Seminar-Workshop (Rancho Santa Fe,
California, February 1978)
California Institute of Technology, Earthquake Engineering Research
Laboratory
1979 108p INT7819332
NSF/RA-790212 PB80-113004/NKS

Proceedings of a seminar-workshop dealing with mutual concerns of seismologists and engineers in strong ground motion are summarized. Discussions focused on three major areas: (1) characterization and parameterization of strong ground motion; (2) simulation and modeling of strong motions; and (3) source mechanism and estimation of strong motion for great earthquakes. Individual topics included quantitative prediction of strong motion for potential earthquake fault, recent developments and applications of deterministic earthquake models, application of system identification techniques for local site characterization, modeling of near-fault motions, a dynamic model for the San Fernando earthquake, alternative ground motion intensity measures, statistics of pulses on strong motion accelerograms, an introduction to strong-motion instruments and data, application of synthetic seismograms to strong ground motion studies, semiempirical approach to prediction of ground motions, occurrence of strong ground motions, simulations of earthquake ground motions, and needs of the Nuclear Regulatory Commission in strong motion seismology.

1261. Soil Structure Interaction in Different Seismic Environments (EERC-79/18)
University of California at Richmond, Earthquake Engineering Research Center
Gomez-Masso A, Lysmer J, Chen J-C, et al
August 1979 57p ENV7623277
NSF/RA-790240 PB80-101520/NKS

The current strong interest in nuclear power and the concerns regarding the seismic safety of the facilities involved have generated the development of improved methods of seismic soil-structure interaction analysis. Presented is a plane-strain method for soil-structure interaction analysis consisting of the superposition of the free field motions and the interaction motions, in a generalized seismic environment. The free field is modeled as a horizontally layered viscoelastic medium, and the seismic environment may consist of a combination of S, P, and Rayleigh waves. The soil-structure system is modeled with viscoelastic finite elements, transmitting boundaries, viscous boundaries, and a 3-dimensional simulation. Comparative analyses of the same structure are conducted for an input of R waves and for vertically propagating S and P waves in a rock site and a sand site. In the rock site the R waves produce higher peak horizontal spectral acceleration up to 25 percent and a significant rocking effect at points away from the center of gravity of the structure. However, the S and P waves show a higher peak vertical spectral acceleration by up to 15 percent at the center of the structure. Very similar horizontal response, but higher vertical response only at the center of the structure for S and P waves, is obtained for the sand site.

1262. Recommendations for a U.S.-Japan Cooperative Research Program Utilizing Large-Scale Testing Facilities (EERC-79/26)
University of California at Richmond, Earthquake Engineering Research Center
September 1979 125p ENV7680835
NSF/RA-790241 PB301407/NKS

The overall objective of the recommended program is to improve seismic safety practices through studies to determine the relationship among full-scale tests, small-scale tests, component tests, and analytical studies. Included are: (1) the objective of the recommended program; (2) background information pertinent to the report; (3) summaries and resolutions of the four U.S.-Japan Planning Group Meetings; (4) recommended research related to reinforced concrete building structures, steel building structures, pseudo-dynamic test method, and analytical studies; and (5) concluding remarks on the overall cooperative program.

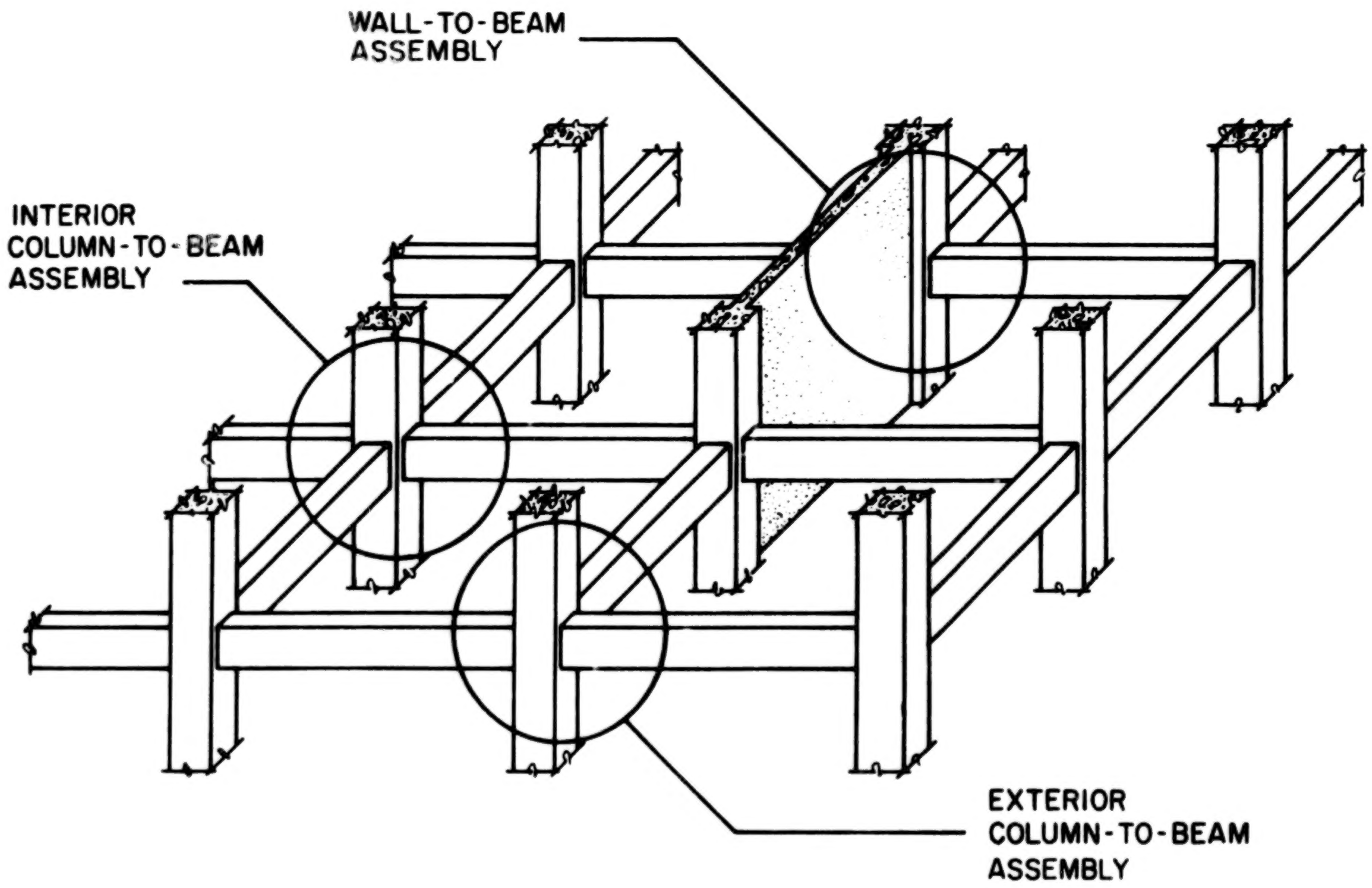

WALL-TO-BEAM ASSEMBLY
INTERIOR COLUMN-TO-BEAM ASSEMBLY
EXTERIOR COLUMN-TO-BEAM ASSEMBLY

FIGURE 5. PORTIONS OF BUILDING TO BE EVALUATED IN SUPPORT TESTS

See Entry 1262.

1263. Approach to Damage Assessment of Existing Structures, Technical Report
Purdue University, School of Civil Engineering
Yao JTP
October 1979 32p ENV7705290
NSF/RA-790245 PB80-123482/NKS

Application of fuzzy sets as an alternative or supplementary approach to assessing the damage state of existing structures is described. Following occurrence of a hazardous event such as a strong-motion earthquake, voluminous data usually are collected, and a simplistic conclusion is issued which transmits scant information to structural engineers concerned with such problems. To correct this situation, the theory of fuzzy sets has been applied to the complex problem of assessing damage to existing structures. Fuzzy sets consist of a mathematical model coupled with provision for the effect of human factors and construction process and experience. For each factor, the gravity of the adverse effect and its consequence are estimated by experts. The report summarizes the state of the art of damage identification of existing structures and presents the fundamental elements of fuzzy sets and their pilot application to actual structural engineering examples. Finally, an approach using fuzzy sets is formulated and discussed in the hope that such a pilot study will stimulate interest in this method among structural engineers.

1264. Earthquake Hazards and Local Government Liability, 1979 Final Report
Association of Bay Area Governments
Margerum T
June 1979 47p ENV7707496
NSF/RA-790246 PB80-116924/NKS

The major objectives of the project were as follows: to clarify the nature and extent of local government's liability for property damages and personal injury resulting from specific situations involving earthquakes; to assess the current and potential impact of tort liability on the willingness and ability of local governments to mitigate earthquake hazards; and to define alternative legislative and administrative strategies that would help local governments to better deal with the potential liabilities in a manner supportive of increased seismic safety for their citizens. Included are sections on nature and extent of local government liability for hazard reduction programs, assessment of current and potential impacts of tort liability on local hazard reduction programs, recommendations for possible administrative and legislative changes, implementation and dissemination, and project evaluation and comments on future research needs.

1265. ANSR-II. Analysis of Nonlinear Structural Response, User's Manual (EERC-79/17)
University of California at Berkeley, Earthquake Engineering Research Center
Mondkar DP, Powell GH
July 1979 90p ENV7604234
NSF/RA-790266 PB80-113301/NKS

Analysis of Nonlinear Structural Response (ANSR) is a general purpose computer program for the static and dynamic analysis of nonlinear structures, including both large displacements and inelastic effects. In two previously published reports, the theoretical formulations, features, and organization of version I (ANSR-I) of the program were documented. This report describes an extended version of the program (ANSR-II). Several features have been added. The most important of these are: (1) a comprehensive restart option; (2) provision to allow static and dynamic analysis in any sequence; (3) provision for static analysis with prescribed nodal displacements as well as nodal loads; (4) provision for out-of-phase support motions to be specified for earthquake analysis; (5) provision for time delay (traveling wave) effects to be specified for forces and displacements in dynamic analyses; and (6) out-of-core solvers for both symmetrical and unsymmetrical equations. The procedure for adding new elements to the program is described, and a user's manual for the main program is given. The elements in the element library of the program will be described in separate reports.

1266. Prediction of Earthquake Resistance of Structures, Final Report
Polytechnic Institute of New York
Wang P-C
January 1980 200p PFR7614893
NSF/RA-800013 PB80-170731/NKS

The prediction of structural resistance to earthquakes provides the focus of this report. Particular attention was paid to developing an upper bound or critical ground excitation for a structure of major importance, so that a high level of confidence in the prediction of structural resistance may be achieved. The term "critical excitation" is defined here as the one among a class of credible excitations at a given site that will produce the maximum response peak for a given structural design variable in question. Both linear and nonlinear structures were considered. To verify its practicality, the method was applied to several nuclear reactor structures. The results show that the method is conservative but not overly so. The responses obtained from the critical excitation are in the range of 1.1 to 2 times those produced by recorded earthquakes of the same intensity. To further enhance the practical applications, response spectra for different soil conditions were also produced.

1267. Selection of Important Strong Motion Earthquake Records
California Institute of Technology
Lee DM, Jennings PC, Housner GW
January 1980 311p PFR7723687
NSF/RA-800021 PB80-169196/NKS

This report comprises a collection of data on 45 strong and/or historically important earthquake-generated ground and building motions. These data are presented as accelerogram and integrated velocity and displacement time histories. Linear, absolute acceleration, relative velocity, and relative displacement response spectra are given for all the ground motions presented. Since a major aim was to allow comparisons of different ground motions, the time history and response spectra plots were plotted, wherever possible, to fixed vertical and horizontal scales. A short introduction is given to earthquake recording instruments and recording networks using these devices. The sources from which the data were drawn are identified and information given to enable one to obtain printed copies or magnetic tape copies of these data or any of the other earthquake data recorded in the U. S.

1268. Commonality of Earthquake and Wind Analysis
University of Illinois at Urbana-Champaign
Cevallos-Candau PJ, Hall WJ
January 1980 210p ENV7508456, ENV7707190
NSF/RA-800022 PB80-178312/NKS

The common features of general dynamic analysis procedures employed for evaluating the effects of wind and earthquake excitation were investigated. A major goal was to investigate and develop a basis for generating response spectra for wind loading which would permit the use of modal analysis techniques for wind analysis in a manner similar to that employed for earthquake engineering. Random vibration techniques were applied for developing response spectra for wind loading. In order to generate wind response spectra, the wind loading is divided into two parts--a mean load treated as a static component and a fluctuating load treated as a dynamic component. The spectral representation of the wind loading constitutes a simple procedure for estimating the forces associated with the dynamic component of the gusting wind. Several illustrative examples are presented demonstrating the commonality.

1269. Free Vibration Tests of Structural Concrete Walls and Analysis of Free Vibration Tests of Structural Walls
Portland Cement Association, Construction Technology Laboratories
Oesterle RG, Fiorato AE, Aristizabal-Ochoa JD
February 1980 43p PFR7715333
NSF/RA-800043 PB80-191232/NKS

This report describes experimental free vibration tests and results conducted during lateral load tests to determine frequency and damping characteristics of isolated wall specimens. This study is part of an experimental and analytical investigation of structural walls for earthquake-resistant buildings in which large isolated reinforced concrete wall specimens are tested under reversing in-plane lateral loads. Initial tests were conducted on specimens before applying lateral loads, whereas final tests were performed on specimens that had been cycled through large inelastic deformations. The report details test specimens, the test procedure, and test results. Small amplitude free vibration tests of isolated structural walls indicate that frequency and damping characteristics are sensitive to the development of structural cracks in the walls. With increasing damage levels, frequency decreases and damping increases. These observations need to be considered in analyzing the dynamic response of reinforced concrete wall systems.

Human Nutrition

1270. Development of Methodologies for Rapidly Assessing the Protein Quality of Foods, Final Report
University of Nebraska, Food Protein Research Group
Nesheim R, Anderson R, Bodwell CE, et al
July 1979 185p AER7620692
NSF/RA-790204 PB80-102395/NKS

Two interrelated aspects of protein quality are investigated: *in vitro* measurement of protein digestability, and estimation of protein efficiency ratio via a computational process and a *tetrahymena*-based assay. The *in vitro* digestability procedure duplicates *in vivo* assays over a range of 67.70 to 92.38 percent with an overall standard error of estimate of 2.47 percent. The final computed PER model (DC-PER) predicts values of protein quality over a range of 0.30 to 3.22 PER, with a standard error of 0.23 PER units compared to rat assays. The *tetrahymena* assay predicts protein quality (T-PER) as a function of *in vitro* digestability and the growth of the organism after a 66-hour period with a standard error of estimate of 0.51 PER units. It was found that food additives, spices, and/or spice oleoresins affect organism growth. A comparison between rat and human *in vivo* digestabilities and three *in vitro* protein digestability procedures indicates that the purified enzyme *in vitro* and human pancreatic enzyme assays can be used to accurately predict human and rat *in vivo* protein digestabilities. Further collaborative studies to test the ability to duplicate the four enzyme *in vitro* protein digestability and C-PER protein quality assays are reported.

Problem Analysis

1271. Research Agenda on Science and Technology for the Handicapped, 1978
Workshop (Washington, D.C., November 1978)
American Association for the Advancement of Science, Office of Opportunities in Science
Brown JW, Redden MR
January 1979 57p OPA7825354
NSF/RA-790053 PB301220/NKS

A research agenda in science and technology for the handicapped was designed to provide support for planning a new research program. This workshop sought to involve handicapped scientists and engineers in the planning process. Participants discussed high and low technology, adults and children, basic and applied research, hardware developments, and social science research. Workshop recommendations are categorized first by major disability groups and then listed by those recommendations that cut across disabilities, especially those with policy, educational, and training implications. The research agenda includes mobility impairment, neuromuscular/skeletal disabilities, visual disability, hearing impairment, vocal impairment, psychological and social issues for research, economic issues for research, and principles for operating a program of search and development for the physically handicapped.

1272. Assessment of a Semi-Closed, Renewable Resource-Based Aquaculture System, Progress Report No. 3
New Alchemy Institute
Todd JH, Zweig RD, Doolittle AM Jr, et al
May 1979 135p OPA7716790
NSF/RA-790150 PB80-105471/NKS

Results of four long-term productivity experiments examining the subtleties of aquatic ponds are reported. The experiments consist of testing surface area and aeration, nitrogen input types and rates, fish monoculture under different aeration rates, and comparative growth evaluation. Five basic points are made: fish feeding rates and types affect fish growth; the ecosystem absorbs nutrients potentially toxic to fish; feeding rates affect water quality; water quality affects fish growth; and solar-algae ponds conserve energy. Improvements in the computer system are traced and their implications discussed. Following a decription of the computer models developed to synthesize and draw meaning from the data, a comprehensive model of fish growth and water quality is outlined and future experiments described. Appendices include articles published or submitted for publication.

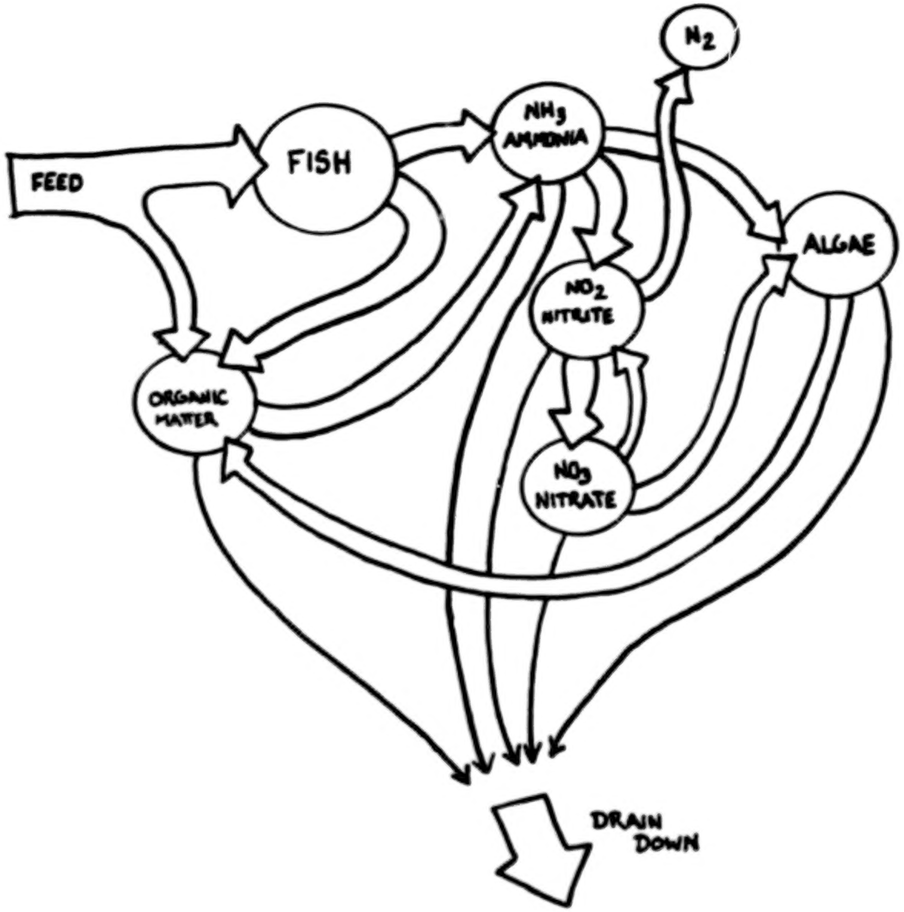


FIGURE 21: PHYSICAL FLOW OF NITROGEN THROUGH THE SOLAR-ALGAE POND ECOSYSTEM:

See Entry 1272.

1273. Health and Human Services Innovations, Report from a Workshop Considering Problems Identified by the Intergovernmental Science, Engineering, and Technology Adivsory Panel, College Park, Maryland, May 30 - June 1, 1979
American Association for the Advancement of Science, Office of Public Sector Programs
1979 272p OPA7824464
NSF/RA-790187 PB80-116932/NKS

This workshop report addresses particular areas of interest expressed by state and local government representatives during a problem identification and consolidation process sponsored by the Intergovernmental Science, Engineering, and Technology Advisory Panel (ISETAP). Areas of interest were: impacts of human service programs; comprehensive health screening services; health care cost control; and integrated human services delivery systems. Separate working groups, considering each of these areas, made recommendations for R & D that might contribute to solutions of problems faced by state and local governments. Recommendations are oriented toward improving the manner in which assessments are conceived and carried out. More uniform reporting data, using archival data, and reviewing the quality and relevance of completed evaluation studies are suggested. Further, recommendations for additional research on impact assessment are evaluated. They include new ways of using program data and of identifying short-term indicators of long-term impacts. The appendices include a list of workshop members and planning groups, the workshop agenda, information on ISETAP, and background papers for each area of interest.

1274. Waste Resources as a Potential Topic for Integrated Basic Research, Workshop on Resource Recovery Research Needs (Gaithersburg, Maryland, December 10-11, 1979)
National Center for Resource Recovery
Abert JG, Bolczak R
March 1980 36p OPA7800657
NSF/RA-800045 PB80-190713/NKS

This report examines the question of whether the subject of waste resources meets criteria for inclusion in the Integrated Basic Research Program of the National Science Foundation. Two workshops were conducted to address research needs in this area and to acquaint participants, mainly from the university community, with current problems. It was concluded that increasing the utilization of waste resources is an emerging national problem of significant relevance. Recycling could provide substantial quantities of resources, and it is estimated that municipal solid wastes for 1980 can yield 272 million barrels of oil equivalent. Recent legislative proposals relate to the national urgency to conserve and develop new sources of energy and materials, thereby reducing dependence on foreign sources. Most resource recovery technology has been borrowed from other countries, leaving a vacuum in basic research to which private industry has not responded. The study concludes that advances in basic understanding will improve the nation's ability to utilize its waste resources. Over 20 research topics are suggested together with examples of specific research projects and traditional disciplines which could address those projects.

General

1275. Recent Awards, April-June 1979 (NSF79-44)
National Science Foundation, Division of Problem-Focused Research Applications
June 1979 23p
NSF/RA-790215 PB80-122187/NKS

This brochure describes the awards made by Problem-Focused Research (PFR) during the third quarter, Fiscal Year 1979. The awards were granted in the following program areas: alternative biological sources of materials; chemical threats to man and the environment; community water management; earthquake hazards mitigation; human nutrition; and science and technology to aid the physically handicappped. The descriptions include title of the grant, name and mailing address of the principal investigator, institution conducting the research, award number, and detailed summary of the project. An explanation of what each program area encompasses precedes the award descriptions, and directions are given for persons wishing to obtain further information on project research.

DIVISION OF INTERGOVERNMENTAL SCIENCE AND PUBLIC TECHNOLOGY (ISPT)

Intergovernmental Program

Local Government

1276. Local Government Science and Technology Network: A National System; Evolution, Characteristics and Lessons Learned
Battelle Southern Operations
1979 65p ISP7920464
NSF/RA-790182 PB80-116692/NKS

The establishment, experience, and future direction of a national networking system to find new and effective ways to help local governments use science and technology are reported. Starting in 1971 with the California Four Cities program, science and technology networks have burgeoned throughout the country. Existing networks vary considerably with respect to geographic scope, constituencies, management agencies, resources, models, policy bodies, and degree of state involvement. Network support mechanisms are described. Thirteen specific lessons learned fall into five categories: network planning and design, role of the individual in science and technology utilization, techology, network operating environment, and network operations. The critical role of people in technology utilization is discussed. Separate sections detail the network operating environment and network operations. The national science and technology network in responding to a diversity of local situations is compiling a creditable record of accomplishments. However, the system's future is clouded by funding difficulties and policy gaps at the national level. Ten network needs are listed.

1277. Process for Local Government R & D Needs Identification and Priority-Setting. Resource Document
Public Technology, Inc.
1979 33p ISP7611055
NSF/RA-790190 PB80-103526/NKS

A handbook developed by the Urban Consortium for Technology Initiatives describes a process whereby 36 of the nation's largest cities are identifying their most urgent research and development (R & D) needs. The handbook is designed as a how-to-do-it guide for identifying and setting priorities for R & D needs of urban jurisdictions. Target audiences include the Urban Consortium, other technology transfer networks serving local governments, individual state and local governments, Federal agencies, and the general research community dealing with urban concerns, e.g., the Community Technology Initiatives Program and Innovation Groups. An explanation of the organizational structure of the Urban Consortium is followed by five instructional sections replete with graphs, figures, forms, and explanatory text. These delineate needs identification process, needs priority-setting process, updating the needs and priorities, problem solution, and lessons from experience. An appendix contains a needs survey package and blank forms.

1278. Priority R & D Needs of Urban America, Resource Document
Public Technology, Inc.
1979 22p ISP7611055
NSF/RA-790191 PB80-106164/NKS

Priority statements for 1977 and 1978 of ten task forces of the Urban Consortium for Technology Initiatives are reported. The consortium is a national cooperative of 36 cities and urban counties established to identify research and development (R & D) needs of urban governments and to channel resources into the most critical areas. By identifying and establishing priorities for urban needs the consortium provides local governments with a structured means of working together with the nation's R & D resources. Networking of local governments also provides collective purchasing power. Priority needs were identified by each of the following task forces: Community and Economic Development, Criminal Justice, Energy Environmental Services, Fire Safety and Preparedness, Health, Human Resources, Management (finance and personnel), Public Works and Public Utilities, and Transportation.

1279. Energy Conservation Measures for the Charles E. Shea Senior High School, Pawtucket, Rhode Island, Public Service Report
New England Innovation Group
July 1979 36p ISP7720656, ISP7680702
NSF/RA-790192 PB80-106610/NKS

A thermographic audit of a Pawtucket, Rhode Island, high school is reported. Conducted with the aid of an infrared camera system, the audit located heat losses not evident to the naked eye. Heat losses were documented and thermograms analyzed to obtain complete knowledge of the location of all heat losses from the building complex. Each thermogram showed one or more types of heat loss and the section of the building where each occurred. Priorities were assigned to various retrofit processes, and a thermographic inspection was conducted after retrofitting to confirm its efficacy. The study comprised an analysis and recommendations of heat loss and heating system appraisals plus an analysis of roof moisture inspection. Results demonstrated thermographic inspection to be a highly effective analytical technique for appraising the relative thermal efficiency of buildings. Based on evidence from the thermographic energy audit, low-, moderate-, and high-cost options were prepared for reducing heating costs. The importance of energy management as an ongoing effort is emphasized.

1280. Public Managment Assistance Through the Use of International Resources, A Preliminary Guide to Innovations and Contacts Explored in the Phillipines, Australia, and New Zealand, February 1979
International City Management Association
Mestres JL
June 1979 82p ISP7801818
NSF/RA-790193 PB80-103468/NKS

Results of innovative local government briefings between American public interest groups and their counterparts in the Phillipines, Australia, and New Zealand are reported. This project was designed to improve communications and strengthen institutional relations among the groups involved and to seek innovations which are potentially transferable to local governments in the U.S. The report, highlighting those concepts, approaches, structures, and programs of an innovative nature, comprises three major sections of management interest: policy management is discussed in terms of the problems and features of local goverment management structures and practices; resource management studies describe various management development programs that are being established as an integral part of local government associations' services; and program management studies detail specific innovative programs in ten areas, including science and technology, alternative energy sources, and housing and social services.

State (Legislative) Government

1281. Institutional Change and Legislative Performance, a Seminar for Legislative Leaders (Palm Beach, Florida, August 20-23, 1978)
State Legislative Leaders Foundation
1979 53p 78SP1107
NSF/RA-790057 PB80-101108/NKS

The seminar consisted of the following presentations: legislative change in retropsect; institutional change and legislative performance; evaluation and oversight; building high performance leadership; and managing the legislative process. Crisis management by the leadership was discussed. Conflicting budgetary demands for more social progress through spending, on the one hand, and for fiscal restraint, on the other, are seen to create a crisis for the leadership. Staff increases are seen to result in more legislation and in a new class of highly informed people who seek careers in the legislatures. While one effect is a better-informed, more full-time legislator, another effect is the tension created between the newer, career-oriented members and the older, citizen-oriented legislators. Increases in the use of computers and other technical aids were reported along with increases in the amount of legislation, staff, legislators' compensation, and time spent by legislators. Comparison in a legislature before changes and after changes was judged to be the optimal way to assess the impact of changes as it keeps extraneous events and conditions in the environment controlled. States should not be compared to each other since each is unique.

1282. Institutional Change and Legislative Performance, a Study of Change in Two State Legislatures by the State Legislative Leaders Foundation, Appendices (A-K)
State Legislative Leaders Foundation
1979 467p ISP7714688
NSF/RA-790101 PB80-114051/NKS

This report consists of 11 appendices based on a study of change of the Wisconsin and Iowa state legislatures. They include an organizational theory of legislative performance and change, a list of variables studied in the project, operational indicators of concepts, a code book for legislative bill data, questionnaires and interview instruments, frequency of responses from Wisconsin and Iowa respondents to questionnaire items by chamber (Appendices F and G), a code book for master analysis of legislative processing effectiveness, coding procedures for policy-area data generation, change in legislative variables for 1967-78, product moment correlation coefficients for bivariate analysis, and tables of statistically significant correlations.

1283. Setting and Achieving Goals of ND-REAP
North Dakota Regional Environmental Assessment Program
Giddings RV, Bond VF
1979 101p ISP7813295
NSF/RA-790142 PB80-101645/NKS

The 1975 North Dakota legislature established a legislative branch research and information program, the Regional Environmental Assessment Program (REAP). The concept of REAP is that of a comprehensive and integrated system for assessment of the impact of natural resource development on economic, social, and environmental parameters. The system was designed to serve primarily the legislature and state agencies and secondarily political subdivisions, federal agencies, private industry, institutions of higher education, and the public. Resolution of the following issues concerning REAP is reviewed: REAP as a scientific computing center; providing and developing services; adding staff vs. contractual agreements; charges; funding; geographical area of interest; scientific and technical activities; role with respect to "state data"; and service to state government. REAP's effort in issue identification and resolution identified problem areas that may be applicable to other states considering development of scientific and technological capabilities for state legislatures.

1284. Study of Methods of Using Science and Technology in the South Carolina Legislative Process
South Carolina Legislative Council
Tyer CB, Graham CB, Stevenson NB
January 1979 93p ISP7802507
NSF/RA-790229 PB80-116437/NKS

A study of ways in which the South Carolina legislature can access reliable, objective information about science and technology (S & T) related issues is reported. The project involved: (1) review and assessment of previous attempts to improve methods of utilizing S & T within the state's legislative process; (2) assessment of the experience of other states to ascertain their relevance to South Carolina's needs; and (3) development of alternative options for South Carolina with appropriate financing options identified. Attention focused primarily on the option involving development of a legislative-university linkage. In-house options also were explored. The external resource model selected was the Pennsylvania system in which the Legislative Office for Research Liaison successfully utilizes university resources in the legislative process. Issue areas in legislative-university linkages that require attention are identified together with those that need to be resolved to implement a university-legislative linkage model in South Carolina.

1285. The Alaska Council on Science and Technology: A Preliminary Assessment (SSET)
University of Alaska, Institute of Social and Economic Research
Morehouse TA, Leask L
February 1980 52p ISP7815340
NSF/RA-800032 PB80-190465/NKS

First-year organization and activities of the Alaska Council on Science and Technology (ACST) are reviewed. ACST is authorized to survey research needs of the State and to recommend priorities for research funding to the governor and legislature. Also, the Council responds to requests of the governor and legislature for scientific advice on State policy issues. The ACST is authorized to award research grants and contracts, promote appropriate standards for research, and establish committees and task forces of scientific and other experts. The report discusses the State Science, Engineering and Technology (SSET) Program and State policymaking and organization. It also discusses activities of ACST,

ACST problems and prospects, and conclusions. The ACST has concentrated its efforts on promoting the building of long-term academic and foundation institutions in Alaska. It also desires to determine a broad range of policy research needs and priorities. At this stage, the Council favors a university-based science community for a council-academy-foundation structure. The appendix includes the Alaska Science and Technology Act, a list of interviews, and extensive references.

Federal Laboratories

1286. Federal Laboratory Consortium, Examples of Products and Processes for Potential Commercialization from Federal R & D Laboratories
Naval Weapons Center
September 1979 166p ISP7718694, ISP7822221
NSF/RA-790213 PB80-116411/NKS

Examples of technologies resulting from Federal research programs available for potential commercialization, especially by small businesses, are described. Information provided for each sample is not comprehensive. Rather, it is a means of stimulating awareness of the products of Federal research and development programs. A contact is cited for each example, should more information be desired. In addition, information concerning patent status and related publications is included. Examples are described in four process, four product, and one service categories. The broad processes covered are mechanical (e.g., scratch-resistant plastic lenses), electronic (an x-ray magnifier), chemical (a method of reclaiming waste lubricating oil), and energy (a method for maximizing shale oil recovery from an underground formation). The four product groups comprise mechanical (e.g., ocean sampler), electrical (rechargeable nickel-zinc batteries), food (precooked fruits and vegetables), and medical (ultrasonic diagnosis of tissue damage in severe burns). The services category is illustrated by a regional analysis model of residential water heating options.

Industrial Program

University/Industry Research Centers

1287. New England Energy Development Systems Center (NEEDS), An Experiment in University Industry Cooperative Research, Volume 1, Summary of Results
Mitre Corporation
Kohorn Z
July 1979 39p CG00007
NSF/RA-790260 PB80-112972/NKS

The organizational structure, operating mechanism, accomplishments, and lessons of the New England Energy Development Systems Center (NEEDS) are reported. NEEDS was established in the MITRE Corporation as an entity to test the effectiveness of Federal cost-sharing in stimulating nonfederal investment in university research, and in facilitating the use of research and development results by industry. Its primary function is to act as a broker linking 20 universities with 28 private organizations in the energy field, with initial emphasis on the New England electric power utilities. Activities were conducted in four functional areas: research and development, information dissemination, recruitment of participants, and data collection and analysis. Twenty-five projects are described and categorized as to performance, source of cost-sharing, and total project cost. Accomplishements in (1) linking private-sector organizations with universities, (2) stimulating cost-sharing from the private sector, and (3) facilitating use of results are discussed. Lessons learned deal with the center's role as a broker, the effectiveness of university-industry cooperative research, and private-sector organizations as cost-sharing partners.

1288. New England Energy Development Systems Center (NEEDS), An Experiment in University Industry Cooperative Research, Volume 2, Case Histories
Mitre Corporation
Kohorn Z
July 1979 140p CG00007
NSF/RA-790261 PB80-112980/NKS

Case histories of 25 projects involving the New England Energy Development Systems Center (NEEDS) as a broker, sponsor, and/or research development (R & D) performer are reported. Case histories are presented from the perspective of NEEDS's management and do not explicitly attribute accounting, proposal, and contract administrative functions to the MITRE Corporation, within which NEEDS operates as a separate entity. Projects are grouped into the energy areas of electricity generation, electrical distribution, and regional energy planning. Each case study is sequenced under the following headings: project description, problem identification, recruitment, R & D funding, project management, R & D program, information dissemination, evaluation, and references.

Technology Innovation Projects

1289. Studying the Feasibility of Automatic Poultry Handling and Transfer Techniques in the Poultry Processing Industry (Final Technical Report, August 1, 1977 - January 31, 1979)
Georgia Institute of Technology, Engineering Experiment Station
Cassanova RA, Atkins RD, Moriarty LJ
May 1979 67p ISP7709749
NSF/RA-790171 PB80-106412/NKS

A project to determine the state of the art in U.S. poultry processing equipment and to identify functions that could benefit by improved mechanization or automation is reported. The project is composed of three tasks: (1) to survey 12 broiler processing plants to determine current handling procedures, space limitations, and constraints, study current handling research and the applicability of new technology, and evaluate alternative handling systems; (2) to evaluate the economic feasibility of alternate handling systems; and (3) to define the most practical and cost effective approach. Results suggest that many plants could be improved significantly by modernized equipment, tighter quality control (an efficient yield evaluation system was developed and demonstrated), better training procedures for processing line personnel, and a more dynamic personnel program. Specific handling concepts generated by the study deal with giblet stuffing equipment, a centralized monitoring system, an inventory control system, shackle identification, conveyor designs, hermetic seal applications and a gamma ray weighing device.

1290. Field Study of High Pressure Water Jet for Highway Surface Maintenance, Final Report
IIT Research Institute
Hilaris JA
February 1980 50p ISP7815857
NSF/RA-800017 PB80-164767/NKS

The performance of high pressure water jets in highway surface repair is evaluated. Field tests were performed on a bridge in the metropolitan Chicago area. Both partial depth and full depth repairs were cut with optimum water jet parameters. Results indicate that a water jet can repair highway surfaces faster than any conventional method. Also, the cutting rates and repair costs for the water jet are substantially more favorable than for the jackhammer or any other conventional method. Additional advantages of the water jet are much lower noise levels, absence of dust, automated operation, application to numerous types of highway repairs, a roadway left wet for immediate pouring of new concrete, cleaned reinforcing bars which eliminate sandblasting, no damage to surrounding materials, and elimination of tool wearing expense since no tool is used.

1291. Study of a Mechanism to Foster University/Small Business Interaction--Phase I, Final Technical Report
Maynard Research Council
February 1980 177p ISP7714151
NSF/RA-800018 PB80-178270/NKS

This project was undertaken to find effective methods of stimulating technology transfer between academic institutions and small businesses. Special attention was given to methods of reducing existing barriers. The report presents the background and history of the project, its rationale, methods and procedures, changes in approach and personnel, and findings. After contacting small businesses in western Pennsylvania by letter and questionnaire, project personnel visited interested businesses to identify problem areas which in turn were transmitted to an academic resource. Two work contracts resulted, both between small businesses and a private firm rather than an academic institution. However, many contacts did occur between academic and small business personnel. Findings show that there is a great difference between small business and academic personnel in the consideration given to problem importance, time required to solve problems, and cost factors involved. Since no system appears to exist in the United States for effective transfer of technology, time and effort will be required to improve communications, alter attitudes, and improve working relationships among the parties involved.

1292. Organic Compounds in an Industrial Wastewater: A Case Study of Their Environmental Impact
Massachusetts Institute of Technology, Department of Chemical Engineering
Lopez-Avila V, Hites RA
March 1979 274p ENV7513069
NSF/RA-790109 PB80-124704/NKS

The biogeochemistry of organic compounds discharged by a specialty chemicals manufacturing plant was assessed. The compounds ranged in concentration up to 50 ppm in the plant's industrial wastewater and 0.2 ppm in its receiving river water, but up to 7000 ppm in river sediments. The wastewater compounds showed a high environmental stability due to their intentional chemical stability. Certain phenolic oxidations were the only chemical transformations in the wastewater/river system. No major degradation products were identified. Analysis of the sediment cores indicated high concentrations of the compounds. The association of organic compounds with the suspended particulates in the river and their eventual deposition seem to cause the accumulation of organic compounds in the river sediments. Significant correlations found between *n*-octanol/water partition coefficient and aqueous solubility and the environmental factor indicate that compounds with a water solubility less than 5000 ppb and an *n*-octanol/water partition coefficient greater than 10^5 tend to accumulate in the sediments. A compartmentalized model for the transport of Tinuvin P in the river and estuary was developed.

1293. SO_2 Oxidation Rate on Well-Characterized Surfaces, A Laboratory Study (Final Report, May 15, 1978 - May 14, 1979)
State University of New York at Albany; Rensselaer Polytechnic Institute
Mohnen VA, Hudson JB, Cheng RJ, et al
1979 68p ENV7681817
NSF/RA-790126 PB301288/NKS

Results of a series of surface measurements involved in the oxidation of sulfur dioxide are reported. Measurements were made of the total sulfur uptake of samples maintained in static atmospheres of sulfur-containing gases and the dynamics of the interaction of various atomospheric gases with several laboratory-prepared vanadium oxide surfaces. The principal conclusion is that the rate of oxidation of sulfur dioxide on vanadium pentoxide melted onto a molybdenum holder is below the detectability of the analytical techniques employed. Neither direct measurement of product flux from the surface nor measurement of product build-up has provided unequivocal evidence of a surface reaction. Possible reasons for the nonactivity of the vanadium oxide sample are discussed and possible promising areas for future research listed. Chemical and physical measurements of surface sulfate on coal and oil fly ash surfaces are reported and recommendations offered for future work.

1294. Remote Measurements of Air Pollutants, Final Report
SRI International
Murray ER, Byer RL
January 1980 97p ENV7710198
NSF/RA-800014 PB80-164791/NKS

The development and demonstration of laser techniques for performing remote measurements of air pollutants are described. The investigation focused on the Differential Absorption Laser radar or DIAL technique to detect trace constituents of the atmosphere. DIAL system measurements of $N0_2$, $S0_2$, 0_3, HCl, CH_4, N_20, H_20, and $CH_2=CH_2$ in various spatial regions demonstrate the feasibility of obtaining remote measurements at high sensitivity and long range using currently available technology. Applications of this research encompass measurement of the environment, exploration of new energy resources, and military uses. Specific applications of the DIAL systems include enforcement of air pollution regulations, testing air pollution models, and explorations of regions of geothermal activity. Already results of this research have led to the design, construction, and field run of two generations of ground-mobile systems for measuring $N0_2$, $S0_2$, and 0_3. It has also led to development of remote sensing capabilities to measure biological aerosols and gases of military interest. DIAL systems are being investigated for petroleum exploration.

Community Water Management

1295. Management of Wastewater Residuals with Iron (VI) Ferrate (Final Report, March 1, 1977 - March 31, 1979)
Northwestern University, Department of Civil Engineering
Waite TD
1979 187p ENV7683897
NSF/RA-790125 PB301279/NKS

The potential use of iron (VI) ferrate in the treatment of wastewater is investigated. The report focuses on the disinfection capacity of ferrate against indicator and pathogenic organisms. Organisms for which inactivation kinetics are modelled include E. coli, Salmonella, Shigella, Streptococcus, and f_2 virus. Cursory evaluations were made of several other aspects of wastewater management. Results indicate that ferrate is a good bacteriocidal agent at low concentrations and that E. coli is a good indicator in the enterobacteriaceae group. Gram positive cocci and rods were both far more resistant to inactivation with ferrate than were gram negative rods. The effect of temperature on inactivation was found to be slight while decrease in pH (range 6-8) caused an increase in the bacteriocidal capacity of the ferrate. Experiments using ferrate as a coagulant showed it to be effective for systems of Lake Michigan water plus bentonite clay and for raw settled sewage.

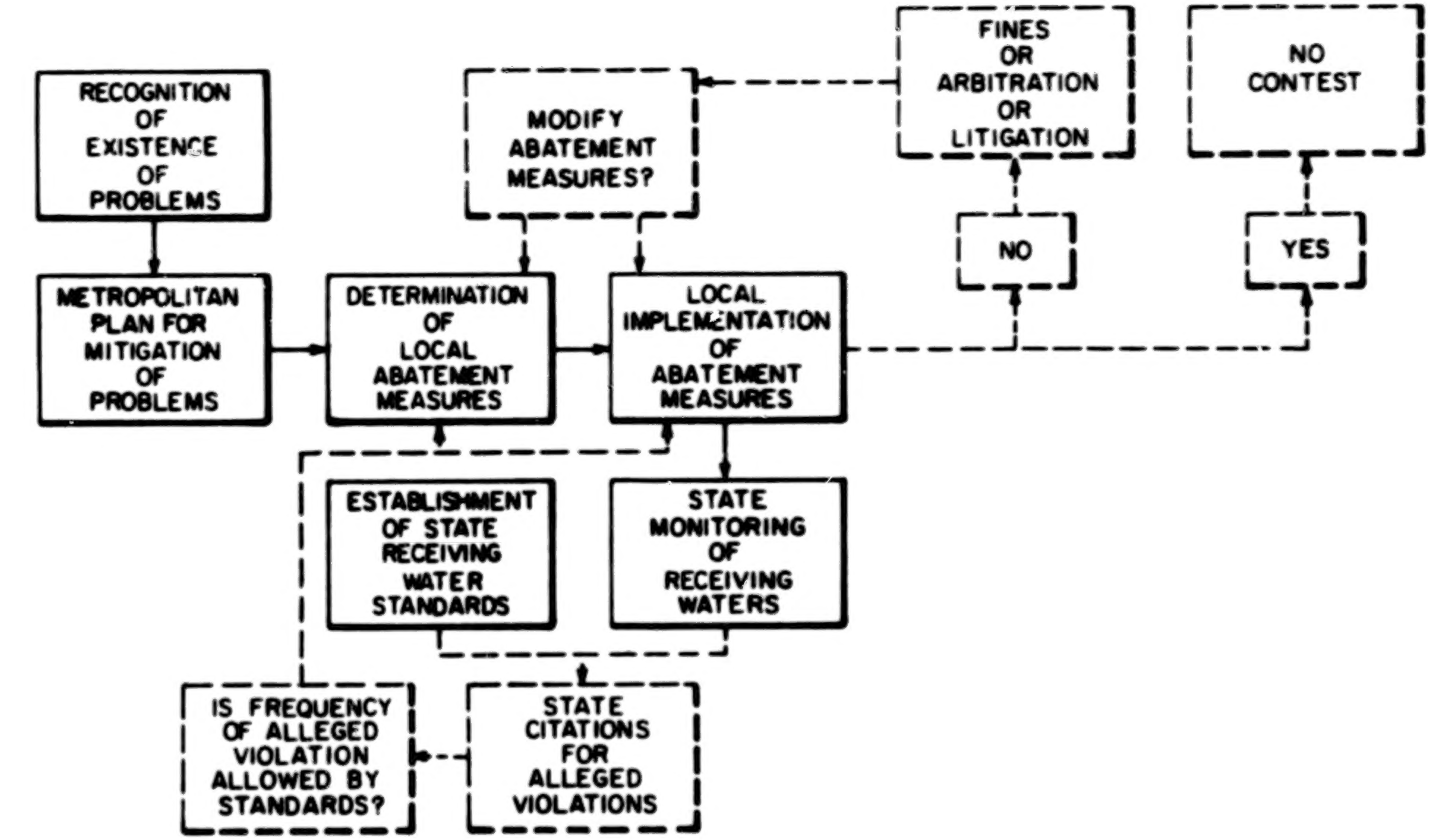

RECOGNITION OF EXISTENCE OF PROBLEMS
METROPOLITAN PLAN FOR MITIGATION OF PROBLEMS
DETERMINATION OF LOCAL ABATEMENT MEASURES
MODIFY ABATEMENT MEASURES?
LOCAL IMPLEMENTATION OF ABATEMENT MEASURES
FINES OR ARBITRATION OR LITIGATION
NO CONTEST
NO
YES
ESTABLISHMENT OF STATE RECEIVING WATER STANDARDS
STATE MONITORING OF RECEIVING WATERS
IS FREQUENCY OF ALLEGED VIOLATION ALLOWED BY STANDARDS?
STATE CITATIONS FOR ALLEGED VIOLATIONS

FIGURE 2. POLLUTION ABATEMENT ASPECTS OF URBAN RUNOFF CONTROL

See Entry 1297.

Reductions in TOC and BOD were also observed. Investigations of the possible oxidation of bromide ions to bromine indicated that it was not likely to be a problem for water and wastewater treatment.

1296. The Thames/Potomac Seminars, an Exploration of Water Resources Management in the United States and the United Kingdom Using the Thames and Potomac River Basins as Examples
Interstate Commission on the Potomac River Basin
Blackburn AM, ed.
July 1979 117p PFR7809532
NSF/RA-790159 PB80-116809/NKS

These seminars were conceived because of similarities between the Thames and Potomac rivers. As important sources of water supply for large populations, the rivers are undergoing extensive clean-up efforts. Discussions explored most of the major water resource issues confronting the United States, the United Kingdom, and most of the industrialized world. The seminars were held in Washington, D.C., and London by representatives of both nations. This report contains proceedings of the Washington Seminar. The search was for elements from either system that could be used beneficially by the other and for suggestions for future research projects. Individual presentations are divided into the following sections: Two Approaches - the U.S. and U.K.; Comparing the Thames and the Potomac; and Drought Management and Water Supply. Reports from work groups address problems of water quality and supply, national programs, and policies and research needs (including international needs). It was discovered that both nations share similar water policy goals but differences in water management legislation, financial support, water quality standards, and pollution control were pointed out.

1297. Challenges in Urban Runoff Control (Planning, Implementation and Simulation), ASCE Urban Water Resources Research Program, Final Report
American Society of Civil Engineers, Urban Water Resources Research Council
McPherson MB
August 1979 47p ENV7715668
NSF/RA-790172 PB80-107873/NKS

Areawide planning for water pollution management has been undertaken in a majority of metropolitan areas under Section 208 of PL 92-500. Urban runoff considerations have been an issue in many of the areas. In an effort to promote long-range conjunctive quantity and quality planning, a dozen seminars, workshops, and conferences hosted by areawide planning agencies were conducted at widely separated urban centers across the country. Reported are responses to points raised at those presentations plus findings from the monitoring of four ongoing local master planning projects. The postponed role of stream standards and the implications of their future enforcement are examined. Plan flexibility, cost allocation, available technology, scale of investments, and technical interrelationships are considered. A generic description of the first phase of four local government two-phase master plans is synthesized, and findings from experiences with simulation of an areawide planning agency are outlined.

1298. Disinfection of Enteric Viruses in Sludge by Energized Electrons, Final Report
University of New Hampshire, Department of Microbiology
Metcalf TG
August 1979 62p PFR7714454, PFR7816851
NSF/RA-790189 PB80-104086/NKS

Disinfection of sludge-suspended virus by energized electron treatment was found to be feasible and effective, and to be a workable alternative to existing methods used to disinfect municipal liquid wastes. A dose of 0.400 megarads was considered adequate for complete disinfection of virus in digested sludge. Disinfection of virus in raw sludge required increased doses. Virus disinfection was regarded to be the result of ionization events that destroyed the functional integrity of vital virion structures. Enchancement of radiation effectiveness was considered the result of increases in the number and extent of ionization events. Suppression of ionization events was followed by a decrease in radiation effectiveness. Sludge organic content was considered responsible for the greater doses of radiation required for disinfection of virus in sludge. Disinfection of effluent but not sludge-suspended virus was enhanced by added aluminum and ferric chlorides. The virus disinfecting effectiveness of the Deer Island radiation unit depended upon the way sludge was presented to the radiation beam and sludge flow rates. The most effective disinfection of virus was obtained with sludge spreaders which presented sludge in relatively uniform thin layers free from large clumps of suspended solids.

1299. Agricultural Value of Irradiated Municipal Wastewater Treatment Plant Sludges, Final Report
Oklahoma State University, Department of Agronomy; University of Massachusetts, Department of Plant Pathology
Kirkham MB, Manning WJ, Bryan EH
1979 183p ENV7704092
NSF/RA-790196 PB80-105158/NKS

A study to determine the availability of nutrients and heavy metals in sludge irradiated with high-energy electrons for disinfection is reported. Differences among plant species' ability to absorb heavy metals in irradiated sludge and the heavy metal availability in different types of irradiated sludge are also examined. High-energy electrons are used because they are intrinsically safer than radioactive sources. Both irradiated and nonirradiated sludges obtained from the Deer Island Wastewater Treatment Plant of Boston, Massachusetts, were used to grow a variety of crops under field and controlled-environment conditions. Results at the end of one and two years indicate that the availability of elements in sludge irradiated with high-energy electrons is similar to that of nonirradiated sludge. Plants grown with irradiated or nonirradiated sludge must be monitored to ensure that metal concentrations are not above normal. Additional studies reported involve earthworms, sludge placement, the relation of cadmium uptake to stomatal resistance, and user applications.

1300. Water Reuse, From Research to Application, Proceedings of the Water Reuse Symposium (Washington, D.C., March 25-30, 1979) Volume 1
American Water Works Association (AWWA) Research Foundation
March 1979 807p PFR7821313
NSF/RA-790224 PB127097/NKS

See entry 1303 for abstract.

1301. Water Reuse, From Research to Application, Proceedings of the Water Reuse Symposium (Washington, D.C., March 25-30, 1979) Volume 2
American Water Works Association (AWWA) Research Foundation
March 1979 860p PFR7821313
NSF/RA-790225 PB80-127087/NKS

See entry 1303 for abstract.

1302. Water Reuse, From Research to Application, Proceedings of the Water Reuse Symposium (Washington, D.C., March 25-30, 1979) Volume 3
American Water Works Association (AWWA) Research Foundation
March 1979 719p PFR7821313
NSF/RA-790226 PB80-127095/NKS

See entry 1303 for abstract.

1303. Water Reuse, From Research to Application, Proceedings of the Water Reuse Symposium (Washington, D.C., March 25-30, 1979) Volumes 1-3
American Water Works Association (AWWA) Research Foundation
March 1979 2386p PFR7821313
NSF/RA-790224SET PB80-127061/NKS

The symposium considered the renovation and reuse of wastewaters from municipal, industrial, and agricultural sources. Unique was the use of poster presentations for enhancing author-participant communication. The proceedings demonstrate that significant global interest exists in wastewater reuse, that recycling concepts are being applied to a broad range of functions, that application of water reuse may be highly situation-dependent, and that reuse

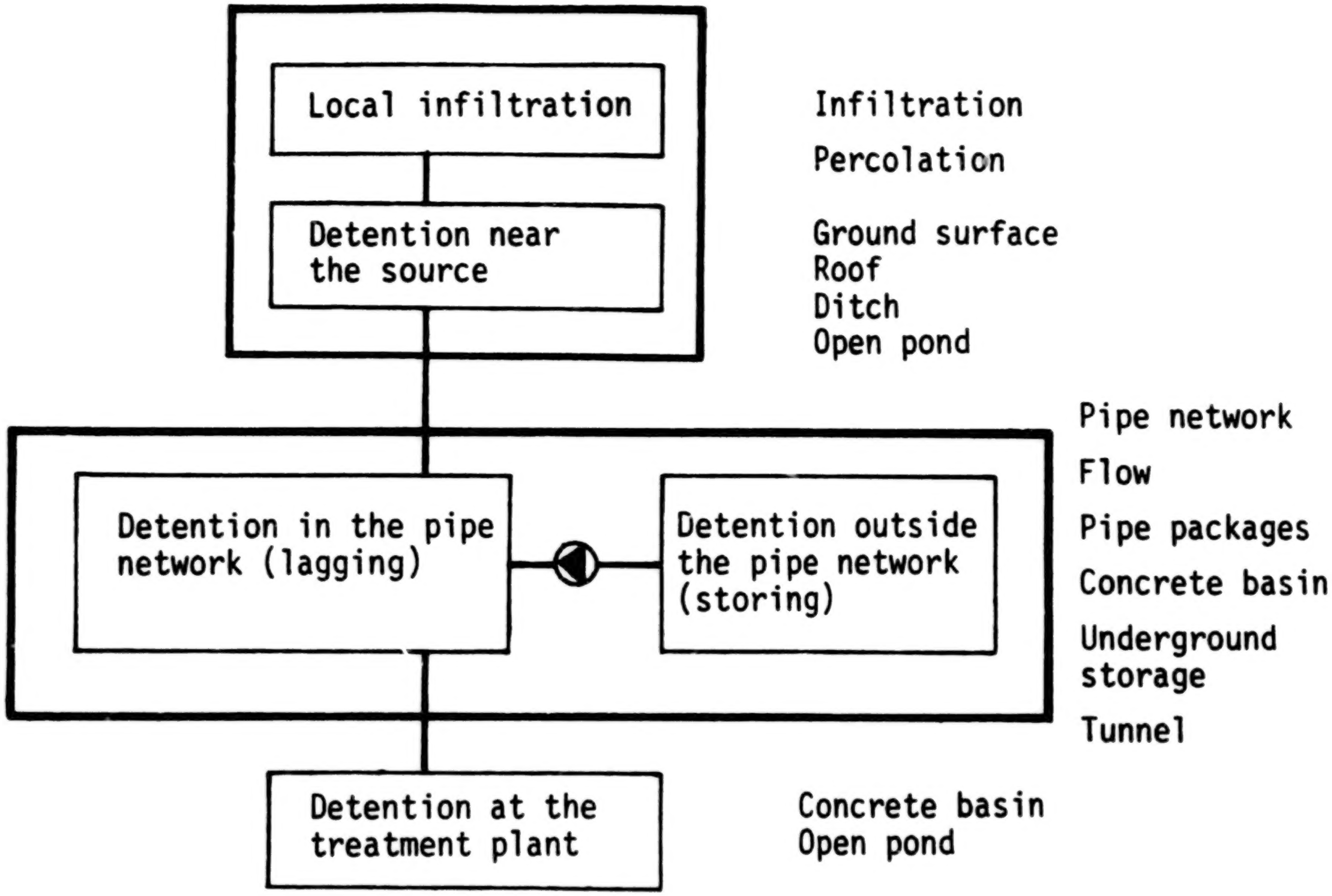


FIGURE 4. SYSTEMIZING DETENTION STORAGE ACCORDING TO LOCATION IN SEWAGE SYSTEM AND EXAMPLES OF TECHNICAL PERFORMANCE (24)

See Entry 1304.

applications are important solutions for the conservation of water. Symposium objectives included provision of program overviews, presentation of research results and practical experiences, provision of a forum for discussing the problems of reuse implementation, and encouragement of information exchange and technology transfer. Volume 1 focuses on implementation, programs, and potential of water reuse policy; water supply augmentation; industrial recycling and reuse; planning for reuse; and aquaculture, wetlands, and eco-systems. Volume 2 describes international developments, institutional factors, and treatment R & D operations. Volume 3 includes municipal reuse; modeling, monitoring, and instrumentation; agricultural reuse; and health and quality considerations.

1304. International Symposium on Urban Hydrology, Proceedings of Two Special Sessions, Spring Annual Meeting, American Geophysical Union (Washington, D.C., May 28, 1979)
American Society of Civil Engineers, Urban Water Resources Research Council
McPherson MB, ed
September 1979 130p ENV7715668
NSF/RA-790249 PB80-123078/NKS

Reports from 11 nations on advances made in the field of urban hydrology since the preparation of original reports during 1975-1977 are included. The study is an outgrowth of the International Hydrological Programme (IHP). Updates are provided for Australia, Canada, United Kingdom, Federal Republic of Germany, Sweden, France, Norway, Netherlands, Poland, India, and the United States. The most obvious change reported for nearly all of the nations is a greatly increased use of urban runoff mathematical models. The report differentiates between urban hydrology and conventional hydrology, presents background information on the development of IHP, including identification of research objectives, and summarizes information obtained from previous international symposia on urban hydrology. A summary of the symposium discussion is included.

1305. Sequencing Batch Biological Reactors - An Overview
University of Notre Dame, Department of Civil Engineering
Irvine RL, Busch AW
February 1979 9p ENV7610381
NSF/RA-790556

The major characteristics of sequencing batch reactor (SBR) systems for biological waste treatment facilities are highlighted. While many design principles and operating practices cannot be known until full-scale performance information is available, sufficient information has been developed to establish certain design and operating criteria and to define the present capabilities of SBR systems. Because of their periodic nature, SBR systems expand the spectrum of treatment capabilities possible from continuous-flow systems alone and are a treatment alternative to the continuous-flow systems now in use. The article is an introduction to six papers on various aspects of SBR operation.

Note: Available from Journal Water Pollution Control Federation, February 1979, pp 235-243.

1306. Sequencing Batch Treatment of Wastewaters in Rural Areas
University of Notre Dame, Department of Civil Engineering
Irvine RL, Miller G, Bhamral AS
February 1979 11p ENV7610381
NSF/RA-790557

Batch treatment, rather than continuous flow treatment, of wastewater generated in rural areas was tested to determine if it would satisfy both current discharge regulations and low cost constraints. It was determined that a single-tank batch system, with little design sophistication, will eliminate algae growth common to lagoon systems, provide for excellent five-day biochemical oxygen demand (BOD_5) and removal of suspended solids (SS), and allow nutrification to proceed to completion. If properly sized and operated, the single-tank batch system will also provide for denitrification. Operation of an experimental system is described in detail.

Note: Available from Journal Water Pollution Control Federation, February 1979, pp 244-254.

1307. Effect of Fill:React Ratio on Sequencing Batch Biological Reactors
University of Notre Dame, Department of Civil Engineering
Dennis RW, Irvine RL
February 1979 9p ENV7610381
NSF/RA-790558

The use of semibatch biological reactors in wastewater treatment is suggested as a way of obviating the difficulties associated with waste concentration surges. Recent advances in process control and digital process computers offer the possibility of simplifying operation of a semibatch plant. In three experiments with bench-scale plexiglass reactors, overall organic load and sludge age were the same, but the fill:react ratio was altered. There appeared to be a definite correlation between settling velocity and the fill react:ratio, with the greatest velocity occurring during two-hour fill and four-hour react and the lowest velocity during five-hour fill and one-hour react. Some conclusions are: (1) a semibatch reactor is virtually without equal in soluble substrate removal; (2) proper design of such reactor depends upon development of microorganisms with satisfactory settling characteristics, which depend upon the fill:react ratio; (3) wastewater may be held in a semibatch reactor until desired effluent quality is reached; (4) semibatch reactors should be considered as a process alternative to conventional continuous-flow systems; and (5) additional research and development at bench-, pilot-, and full-scale levels is needed to develop a unified approach to semibatch design.

Note: Available from Journal Water Pollution Control Federation, February 1979, pp 255-263.

1308. First Cost Analysis of Sequencing Batch Biological Reactors
University of Notre Dame, Department of Civil Engineering
Ketchum LH Jr, Irvine RL, Liao PC
February 1979 10p ENV7610381
NSF/RA-790559

Costs of alternative systems for treating organic wastes are compared on the basis of initial investment rather than on the basis of annual costs, which are expected to be nearly the same for operation of activated sludge and sequencing batch systems. For small rural communities, the sequencing batch system, using the single-cell lagoon, is shown to require the least cost of the alternatives considered. For small towns, the lowest cost system is the aerated lagoon system, which has the disadvantages of poor quality effluents and large land requirements. It appears that the prototype sequencing batch system, a three-tank system, should be constructed at no higher initial cost (and possibly lower) than for a conventional activated sludge system, and it will consistently provide significantly higher quality effluents.

Note: Available from Journal Water Pollution Control Federation, February 1979, pp 288-297.

1309. Tertiary Chemical Treatment for Phosphorus Reduction Using Sequencing Batch Reactors
University of Notre Dame, Department of Civil Engineering
Ketchum LH Jr, Liao PC
February 1979 7p ENV7610381
NSF/RA-790560

Two separate studies are discussed. One used jar-test procedures to test the use of lime for phosphorus reduction in synthetic wastewaters. The other used bench-scale reactors to test the use of ferric chloride for treating a real municipal secondary effluent. Both were conducted to determine the feasibility of operating a chemical treatment, phosphorus reduction, tertiary-type clarifier in a fill-and-draw mode or as a sequencing batch reactor system. The jar-test procedures appear to be an efficient way to evaluate effectiveness of a proposed sequencing batch mode of operation for chemical treatment of wastewaters. Significant savings in chemical costs appear likely when operating a tertiary phosphorus reduction system in the sequencing batch mode using ferric chloride. It also seems that polymer additions necessary in full-size, continuous-flow reactors may be eliminated with quiescent or carefully controlled stirring during settling, further reducing costs as well as lowering sludge production. An additional advantage of the sequencing batch reactor is the possiblity of operating with controlled effluent discharge, eliminating discharge of poor quality effluents.

Note: Available from Journal Water Pollution Control Federation, February 1979, pp 298-304.

1310. Investigation into the Chemistry of the UV-Ozone Purification Process, Final Report
Westgate Research Corporation
Leitis E
February 1980 219p ENV7624652
NSF/RA-800023 PB80-174394/NKS

The synergistic effect of ozone and UV light in the decomposition of organic compounds in water is studied. The nature and quantities of oxidation products by ozonation, UV-ozonation, and hydroxyl radical oxidation were assessed to understand the UV-ozonation mechanism. Nitrobenzene was selected as the primary model compound due to its relative resistance to UV-ozonation. This model compound followed an identical sequence of reactions in both 0_3 and UV/0_3 oxidation via mono-, di-, and trihydroxylation of the benzene ring; the major stable intermediates were oxalic acid, formic acid, and glyoxal. The ratios of 0-, M-, and p-R-phenols produced by ozonation and UV-ozonation of nitrobenzene and chlorobenzene (a secondary model compound) were almost identical and very different from the isometric phenol ratios given by Fenton's reagent and H_20_2/UV systems. Various mono-, di-, tri-, and tetra-substituted benzene derivatives were studied using the oxidation regimes; the kinetics were determined to be pseudo-first order. A hypothesis was advanced that ozone can act also as a nucleophilic reagent towards benzene derivatives with electron withdrawing substituents. The initial work of the pH study has been completed, namely, the effect of very high and very low pH values on the rates of UV-ozonation and ozonation of selected model compounds.

1311. Assessment of the Potential Health Risks Associated with the Injection of Residual Domestic Wastewater Sludges into Soils, Final Report 1, National Conference
University of Texas at San Antonio, Center for Applied Research and Technology
Sagik BP, Sorber CA, Funderberg SW, et al
February 1980 21p ENV7710187
NSF/RA-800024 PB80-169204/NKS

This conference convened scientists, engineers, planners, and Federal, state, and local public health officials for the purpose of assessing the potential public health risks from pathogens and chemical compounds associated with the use of domestic wastewater and sludges on land. It provided an opportunity to evaluate existing data and to define the risks. A major theme was that current wastewater treatment chains, designed and operated appropriately, are probably adequate to reduce much of the potential biological public health hazard from wastewater effluents. Available data suggest that rather than inactivation, what occurs during treatment is sequestering of some of the microbiota and organics into the secondary biomass. The problem then becomes one of sludge handling. The problem of viruses underlies much of the research and is the most commonly acknowledged single restraint on widespread and immediate use of municipal sewage effluents and sludges as potential assets.

1312. Assessment of the Potential Health Risks Associated with the Injection of Residual Domestic Wastewater Sludges into Soils, Final Report 2, Laboratory Studies
University of Texas at San Antonio, Center for Applied Research and Technology
Sagik BP, Sorber CA, Funderburg SW, et al
February 1980 142p ENV7710187
NSF/RA-800025 PB80-169212/NKS

Movement of poliovirus 1, reovirus 3, and bacteriophage 0X174 was studied in nine different soils and two soils amended with sludge. Soils were sampled to a depth of 100 cm in three 33-cm profiles. These profiles were packed into acrylic cylinders, 10 cm in diameter and 33, 66, and 100 cm in length, according to the vertical distribution and bulk density of the soil as found in the field. Viruses were added to the columns in 100 ml of autoclaved secondarily treated wastewater. Columns then were flooded with 800 ml of autoclaved wastewater followed by 800 ml of distilled water for five cycles of wastewater/distilled water application. Column percolates were monitored for viral infectivity, specific conductance, pH, turbidity, and total organic carbon. Cation exchange capacity, percent organic carbon, pH, percent silt/clay, and specific surface area were determined for each soil studied. Recovery of all three virus types in soil column percolates followed a cyclical pattern with a peak of viral release corresponding to a reduction in specific conductance of the percolates after distilled water application. In successively longer columns, the peaks of viral release were lower, and hence the total number of virions recovered from these percolates was less than from the shorter columns. The total number of viruses detected in the column percolates differed among the soils tested. Linear and multiple regression analysis determined that this was due to the differences among soil properties.

1313. Wetland Utilization for Management of Community Wastewater, 1979 Operations Summary (Houghton Lake Wetlands Treatment Project)
University of Michigan, Department of Mechanical Engineering
Kadlec RH, Hammer DE
February 1980 83p ENV7723868
NSF/RA-800026 PB80-170061/NKS

The Houghton Lake Wetland Treatment System operated successfully in the treatment of 65 million gallons of secondary wastewater in the summer of 1978, and 101 million gallons in 1979. Treated wastewater from a holding pond is pumped through a 12-inch diameter underground force line to the edge of the Porter Ranch peatland. There, the transfer line surfaces and runs along a raised platform for a distance of about 2500 feet to the discharge area out in the wetland. The wastewater flowing into the transfer line is split between two halves of the discharge pipe which runs 1600 feet in each direction. The water is distributed evenly across the width of the peatland through small gated openings in the discharge pipe. Each of the 100 gates discharges approximately 16 gallons per minute, under typical conditions, and the water spreads slowly over the peatland. Water quality improvement was achieved as predicted by prior field and laboratory research and computer simulation. The major research areas are listed and sample results are given under the following topic areas: system operation, hydrology, surface water chemistry, litter and soil, vegetation status and response, and algal productivity.

1314. Benefits and Problems of Refuse-Sludge Composting
Cal Recovery Systems, Inc.
Golueke CG, Lafrenz D, Chaser B, et al
March 1980 66p PFR7917407
NSF/RA-800027 PB80-170988/NKS

A high-speed shredder, a rototiller, and a front-end loader were used to evaluate their effectiveness for mixing and aerating mixtures of refuse and digested sludge cake for composting. The material to be composted consisted of a 1:1 (gravimetric) mixture of digested sludge and refuse lights. Three piles were set up, one pile to be processed by each one of the three pieces of equipment being evaluated. Analytical determination included moisture content, total and volatile solids contents, and concentrations of C, N, and some heavy metals. The composting process was completed in 21 days in the pile mixed with the high-speed shredder (pile-1), in 28 days in the pile mixed with the rototiller (pile-2), and in more than 31 days in the pile mixed with the front-end loader (pile-3). The major difference between the piles was in nature and intensity of odors. No putrefactive odors emanated from pile-1, and some putrefactive odors were detected from pile-2. The odors from pile-3 were very strong and objectionable throughout the 31 days of observation. The physical characteristics of the finished product were the best in pile-1 and the worst in pile-3. Results of the research indicate the following: (1) the light fraction of refuse is an excellent bulking agent for composting digested sludge cake, provided the initial mixing and aeration are conducted properly; (2) a machine having the design characteristics of the shredder used in the investigation would best supply the required mixing/aeration; (3) high temperatures and odor-free composting are not always coincidental; and (4) at a 1:1 gravimetric ratio, refuse lights accomplish a substantial dilution of the heavy metal content of the sewage sludge.

Problem-Focused Research

1315. Joint US/USSR Conference on the Production, Selection, and Standardization of Entomopathogenic Fungi of Project V, Microbiological Control of Insect Pests of the US/USSR Joint Working Group on the Production of Substances by Microbiological Means (Proceedings of the First Conference, Jurmula, Latvia, SSR, May 1978)
American Society for Microbiology
Ignoffo CM, ed
March 1979 297p INT7719256
NSF/RA-790164 PB80-106552/NKS

The conference dealt with the production, selection, and standardization of entomopathogenic fungi. The objectives were to (1) review past work and determine the current status of use of entomopathogenic fungi for controlling insect pests in both the USA and USSR, (2) define specific research objectives and identify scientists who will engage in collaborative research, and (3) develop a formal working document to assist in implementing research objectives. Presentations covered both basic and applied research on the feasibility of developing fungi for control of insect pests. Research in the USA and USSR has concentrated on species of Aschersonia, Beauveria, Entomopthora, Hirsutella, Metarhizium, and Nomuraea. The foundation for a cooperative program on entomopathogenic fungi with the USSR under Project V, Microbiological Control of Agricultural Pests, has now been established.

1316. Natural Hazards Observer, Volume 4, Number 1
University of Colorado at Boulder, Natural Hazards Research Application Information Center
Waterstone P, Monday J, Nathe S, eds
September 1979 14p ENV7605682
NSF/RA-790209 PB80-106602/NKS

The feature article describes the creation and objectives of the Federal Emergency Management Agency (FEMA) which consolidates a variety of emergency management activities into a single agency. An article on the proceedings of the Fourth Annual

National Hazards Research Wokshop includes lists of research presentations, new research abstracts, conference summaries, public interest group abstracts, and program/project abstracts. Some preliminary findings entitled "Dissemination of and Response to Natural Hazard Warnings" are reported. "Washington Update" includes articles on land acquisition to reduce flood losses, new additions to FEMA, and a study undertaken by the Water Resources Council on nonstructure flood plain management. Subjects of conference announcements include coastal meteorology, stormwater management, Florida hurricanes, earthquake engineering, American shore and beach preservation, and disaster relief. Grant announcements involve state mitigation options, an emergency assistance handbook update, disaster recovery training, evacuation behavior in disasters, and earth covered buildings. Other articles report conclusions of a research project on the effects of flood plain regulations, the publication of a disaster handbook for extension agents and private individuals, announcements of new monographs, a church response handbook, a mayors' resolution conference, and recent publications.

ENGINEERING AND APPLIED SCIENCE (EAS) - GENERAL

1317. National Science Foundation External Product Evaluation System, Final Report
Kappa Systems, Inc.
September 1979 135p ERS7726721
NSF/RA-790216 PB80-116569/NKS

The first year's experience with and recommendations for improvement in an external evaluation system of National Science Foundation policy and applied research reports are reported. The three basic components of the NSF external product evaluation system include people, criteria, and procedures; and its attributes are access, flexibility, efficiency, economy, and utility/value. During its year of operation, experiments have been made to maximize efficient and effective use of the evaluation system. Experience with the following system components is reviewed and analyzed: products, evaluations, criteria, procedures outcomes, utilization, quality/value, individual report assessment, aggregate data assessment, and product/criteria/evaluation. Specific recommendations for products, evaluation, criteria, procedures, and improved use and credibility are described.

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